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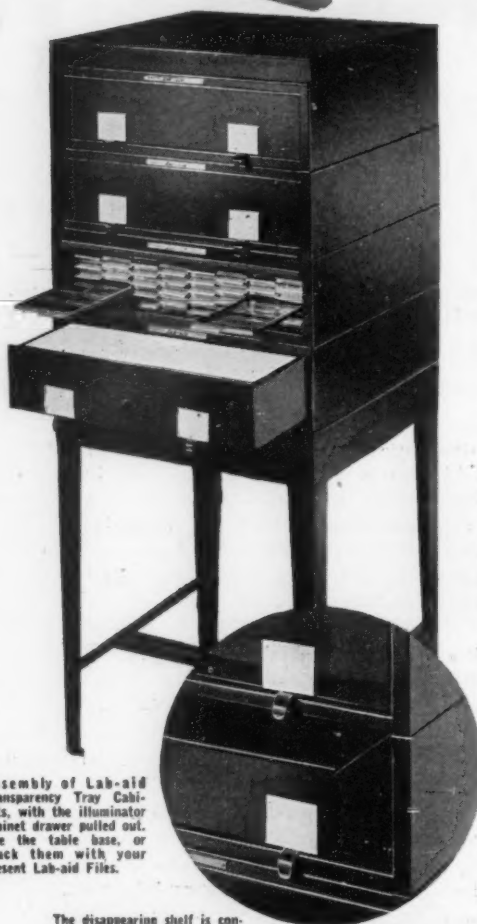
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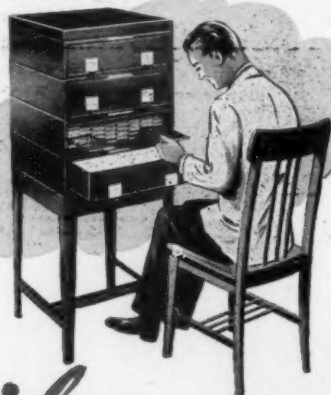
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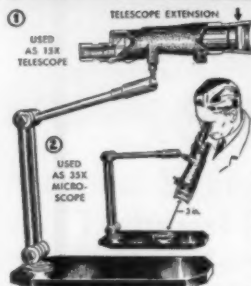
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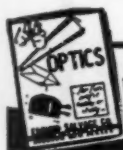
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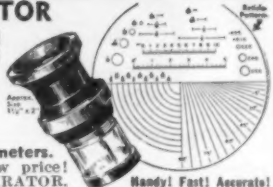
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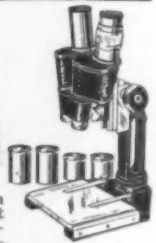


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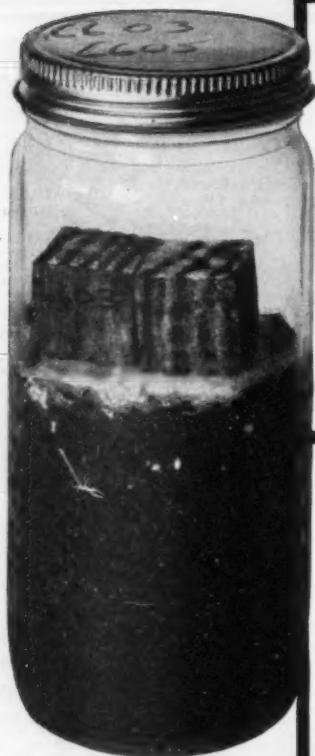
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National Register of Scientific and Technical Personnel

THE registration of scientists, as with other inventories of our scientific potential, must be accomplished by methods consistent with the protection of the traditional freedoms fundamental to the continued advancement of science. In keeping with this philosophy, the professional scientific societies, representing scientists, and the National Science Foundation, representing Government, have identified a mutual interest in cooperatively developing uniform registers of scientific and technical personnel in the various fields of science. The primary purposes of the registers are: 1) to provide standby machinery for the location of scientific talent in the event of a national emergency, and 2) to provide scientific manpower information necessary for the development of policies regarding science. Some professional scientific societies plan additional uses for the registers in connection with their placement programs, to facilitate and to provide a broader base for special surveys of particular interest to the society, to assist in the compilation of society directories and in the furnishing of information for biographical directories.

Accordingly, in the fall of this year several professional scientific societies, with the aid of grants from the Foundation, will begin to distribute to member and non-member scientists in their respective fields brief questionnaires on their educational, technical, and professional backgrounds. The information provided on the returned questionnaires will serve as the basis for decentralized registers to be housed and maintained in the offices of the societies.

The composite of these individual registers will form the National Register of Scientific and Technical Personnel to implement that section of the National Science Foundation Act of 1950, which authorizes and directs the Foundation "to maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information covering all scientific and technical personnel in the United States."

Previous rosters and registers, including the Roster of Scientific and Technical Personnel (1940-47), registrations of scientists and engineers sponsored by the military services (1947-50), and the National Scientific Register (1950-52), were undertaken primarily to meet short-term emergency needs. The present register has been designed as a long-range, continuing program, decentralized, yet flexible enough to serve emergency needs. Normally, registration will cover personnel having four or more years of professional experience in a scientific or technical field beyond the baccalaureate degree or its equivalent. Registrants will be recanvassed periodically in connection with those items of background information which are likely to have changed, in order to keep the records up to date.

Four organizations are now actively engaged in this new program: the American Geological Institute; the American Institute of Biological Sciences; the American Veterinary Medical Association; and the Federation of American Societies for Experimental Biology. Others who are formulating their plans for cooperation in the register are: the American Chemical Society; the American Institute of Physics; the American Mathematical Society; the American Meteorological Society; The American Psychological Association; and the Engineers Joint Council. The American Medical Association has indicated that it will cooperate with the biological groups in the registration of medical scientists. Special procedures will be devised to register any qualified scientific or technical group not associated with the societies named above.

The present registration program has received the warm approval of specialists on scientific manpower and of the professional and scientific organizations. Its success will depend upon the cooperation of scientists and technical personnel in completing and returning the brief questionnaires sent to them. Scientists who do not receive questionnaires may assist in the program by requesting the appropriate professional scientific society, institute, federation, council or association to include them in its mailing list.

HARRY C. KELLY

National Science Foundation, Washington, D. C.

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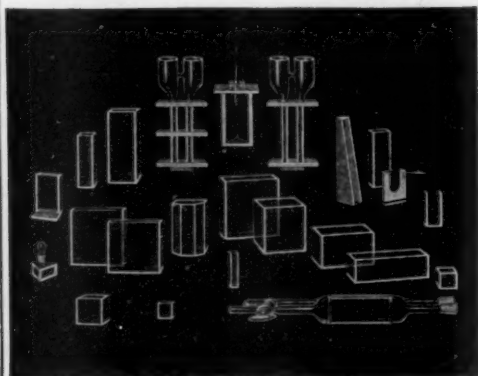


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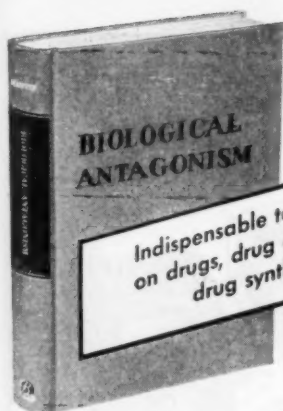
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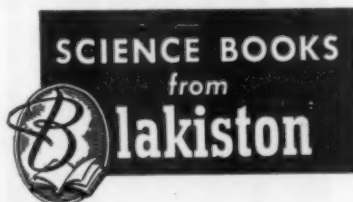
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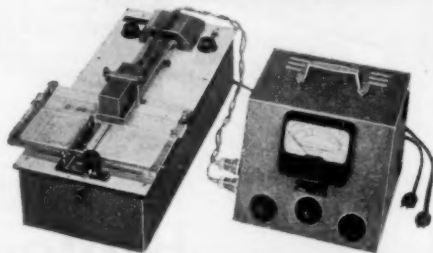


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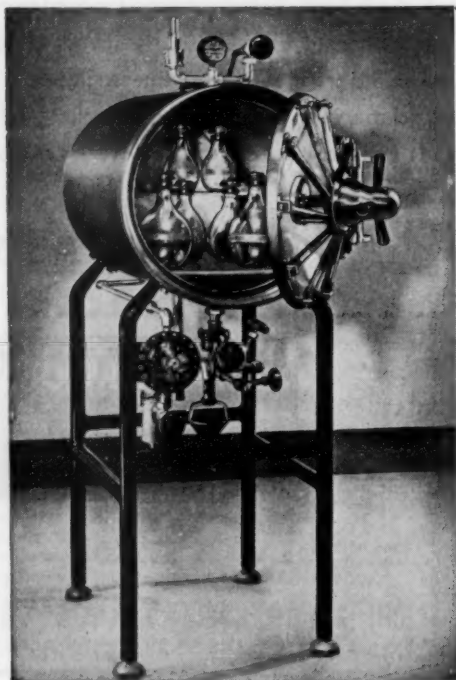
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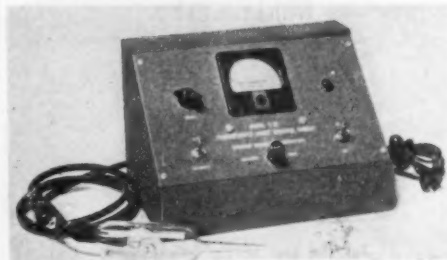
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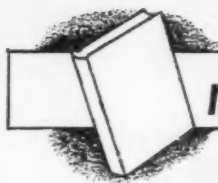
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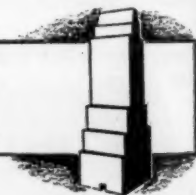
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Indiana Conference on Nuclear Spectroscopy and the Shell Model

Emil J. Konopinski

Department of Physics, Indiana University, Bloomington, Indiana

THE CONFERENCE was held at Indiana University, May 14-16, 1953. It was initiated and organized by A. C. G. Mitchell, head of the Indiana University Physics Department, and was supported by the Office of Naval Research. Over one hundred representatives of twenty-seven laboratories attended. The four sessions were presided over by Gregory Breit, Martin Deutsch, Eugene Greuling, and D. R. Hamilton. Twenty-five lectures introduced the topics for informal discussion.

The discussions were concentrated on interpreting the vast accumulation of data, obtained by nuclear spectroscopy and allied techniques, concerning the behavior of transforming nuclei and their radiations.

Discussions of the Nuclear Model. The primary basis of interpretation was the shell model. However, this has to be greatly elaborated and supplemented beyond its primitive, initial form, owing to the growing refinement of the data.

Initially, only states of nuclei containing odd numbers of nucleons were determined. These were taken as completely characterized when the last odd nucleon was assigned to an orbit; all the paired like nucleons were regarded as inert. Obviously, the model could be extended to nuclei with even numbers of nucleons only by considering the coupling of at least the last two nucleons to determine the state. The more detailed evidence on the nature of actual nuclear states forces the consideration of all the nucleons in at least the last orbital, for some of the states.

Particular members of the paired like nucleons, the famous "magic numbers" 2, 8, 20 (28), 50, 82, and 126, show extra stability: each may be regarded as completing a particularly inert core, in the nuclei containing it. The extra nuclei form a sort of "atmospheric" envelope, stratified into orbital shells.

Before the advent of the shell model, at least the heavier nuclei were treated as deformable "liquid drops" with some success. This model naturally failed to exhibit the marked shell effects which are observed, hence now the liquid drop treatment is accorded only to the magic number core, usually lumped together with the lower, filled shells of the "atmosphere." An excitation of the nucleus may still involve only the nucleons in the last, unfilled shells, as supposed in applications of the pure shell model. However, "tidal waves" in the fluid core can now be conceived to be induced by the "atmospheric" motions. The so-called

collective model of the nucleus treats some states as arising from a coupled motion of core and "atmosphere."

Not all these details which have come to light play significant roles in every experiment. The interpretations made at the conference exhibited every stage of the above picture, according to the elaboration of detail demanded by the individual experiments. Thus, only the orbit of the last odd nucleon needed to be considered in interpreting many of the facts. Examples given the most attention were:

1) L. Nordheim showed the existence of a significant difference in the allowed beta decays of two types of odd nuclei. If the transforming nucleon is the last odd one of both the parent and daughter nuclei then a comparatively rapid decay ensues. The second type is never as rapid: "rearrangement" transitions, in which a pair of like nucleons must be broken up and a new pair formed. [A case (Kr^{85}) of very marked delay by rearrangement was pointed out earlier by Goldhaber.]

2) H. Richards described experiments determining which excitations of a given nucleus involve only the last odd nucleon, and which engage the core. Protons are scattered inelastically from filled-shell nuclei. A wide resonance shows up at each energy which characterizes a single particle state of excitation, of the joint proton-target nucleus system. The longer-lived states in which the whole nucleus shares the excitation energies show distinctly narrower resonances.

3) M. Goldhaber compared odd nuclei which differ only in the number of neutron pairs underlying the last odd nucleon. The energy differences between single particle orbits in these nuclei vary smoothly as the neutron pairs are added in the given series. Quite reasonably, the orbits which come closest to the core are affected the most when it changes. J. Mihelich described an experiment in which a whole series of nuclei differing only by neutron pairs are obtained at once. This was the high-energy proton bombardment of gold, which yields the series by ejecting 1, 3, 5, or 7 neutrons.

Nuclei with both an odd neutron and an odd proton present the problem of the coupling between these in determining the nuclear state.

4) Nordheim showed that the coupling depends on whether each odd particle spins in the same or opposite direction to the orbital rotation. If the two odd

nucleons behave differently in this respect then they tend to cancel each other's angular momentum. Such nuclei have allowed beta decay to the spinless states of their daughters. If the two odd nucleons align themselves relative to their orbits in a like way, then a state of high angular momentum is produced. Such nuclei prefer to decay to highly spinning, excited states of their daughters to avoid overcoming the large angular momenta.

5) P. Hough described an experiment which determines directly the kind of orbit which a neutron enters when attached to a nucleus. If the neutron is one stripped from a deuteron bombarding the nucleus, then the freed proton's direction reveals the character of the neutron's new orbit. When the nucleus already has an odd proton, then it is found that the neutron, although entering its expected orbit, spends a few per cent of its time in an orbit of lower momentum.

Evidence about some nuclear states can be understood only if it is supposed that *all* the nucleons in unfilled shells participate in determining the character of the state in question.

6) E. Feenberg showed how an outstanding difficulty of the shell theory can be cleared up in this way. If only the odd proton of F^{19} is held responsible for its observed spin and magnetic moment, then it must be ascribed a spherically symmetric distribution (S orbit). Yet other nuclei, with equivalent proton or neutron numbers, show that the proton should prefer a higher angular momentum (a d orbit). Now, if *all* the protons which would go into the d orbit are considered together, then this preferred d-orbit assignment works as well as the S-orbit in yielding the correct spin and magnetic moment.

7) M. Mayer showed a striking correlation, between rates of favored beta decay and magnetic moments, which can be obtained by considering contributions of *all* the nucleons to the state character. Both the decay rates and the magnetic moments are extremely sensitive to similar details about the nuclear states. Each type of data shows erratic deviations from the expectations based on necessarily oversimplified state models. However, these two types of erratic deviations are now shown to be closely correlated with each other, qualitatively and quantitatively.

8) A long-standing difficulty for the shell model has been the explanation of why only a certain well-defined group of nuclei shows a favored rate of beta decay. Mayer pointed out that all unfavored decays involve nuclear states which should be determined by at least three like nucleons. The various states which these form differ markedly in symmetry from states into which they decay, high degrees of symmetry being encouraged by the charge independence of nuclear forces. The great alterations needed to transform one type of symmetry to another are supposed responsible for the transformation's being unfavored (violation of isotopic spin conservation).

The gross liquid drop picture of the nucleus is still adequate for understanding fission.

9) J. Brolley described experiments in which fast neutrons were sent against fissionable nuclei. The neutron, as might be expected, induces fore-and-aft oscillations in the "liquid drop" nucleus. This was shown by the preferential ejection of the fission fragments along the direction of the impinging neutrons.

The *collective* motion of fluid *core* and extra-core nucleons clarified many problems.

10) G. Scharff-Goldhaber demonstrated that practically all nuclei with even numbers of neutrons and protons have lowest excitations into even states with two units of angular momentum; the next higher excited states have four units of angular momentum in about a third of the cases, and two units again in another third. K. Ford showed that the *collective* model leads one to expect a first excitation consisting of a *core* rotation with just the two units of momentum found. Four units is one of the alternatives for the second excited state, depending on the extra-core nucleons available for excitation.

11) Goldhaber presented a striking analysis of an odd nucleus (Mo^{93}) which behaves like the even nuclei described in (10). Mo^{93} is exceptional in that it has a highly excited state with a long duration (isomer), yet it has just one neutron outside a magic number core. The long-lived isomers otherwise occur only just *before* the completion of such a core. It seems that it is the extra neutron that is inert during the pertinent excitations of Mo^{93} . The *core* meanwhile goes through the excitations (two, four, and eight units of spin) characteristic of an even nucleus, minus the extra neutron.

12) Scharff-Goldhaber also showed that the first excitations of the even-even nuclei need the most energy when there are fewest nucleons outside the magic number cores. The energy needed is uniformly very low when there are many extra-core nucleons. This conforms to Ford's expectations based on the *collective* model. Many extra-core nucleons pulling tidally on the *core* make it more easily deformable and excitable.

13) Ford also discussed the effect of the *collective* motion on the magnetic moments that deviate from expectations based on single nucleons outside an inert core. Ford could account roughly for the deviations, but only with the added presumption that the presence of many nucleons suppresses the magnetic effects of the meson clouds around each nucleon.

14) *Core* excitation also shows up in the experiments discussed by Hough (5): as a large background (30 to 50 per cent) of isotropically ejected protons. Breit pointed out how large an effect the interference of those protons may have, with the protons analyzed by Hough.

Discussions of the Laws of Beta-Radiation. 1) R. Sherr summarized the evidence that beta decay is allowed, and even favored, between spinless nuclear states. Such transformations require either a *scalar* or a *vector* form of coupling law between nucleons and beta particles (Fermi coupling). This must be

added to the well-established Gamow-Teller coupling (tensor or axial vector form of law). Mayer (7) also had evidence for the two types of coupling. Only the Gamow-Teller type can be correlated with magnetic moments and she found that a Fermi coupling contribution had first to be subtracted before she found her strong correlations between decay rates and magnetic moments.

2) E. Konopinski summarized the evidence that the particular forms of the two couplings are the scalar and tensor, and not the polar or axial vector forms. His earlier evidence, promulgated with Mahmoud, was based largely on the statistical sharing of energy exhibited in certain types of transitions (once forbidden). Measured correlations between the decay fragments of helium definitely now support the tensor over axial vector form of Gamow-Teller coupling.

3) Konopinski also discussed the pros and cons of the single piece of evidence (spectrum of RaE) that a third component of coupling, a pseudoscalar form, must also be added to the beta interaction. The third component is needed to interfere destructively with the others, to account for the slow decay of RaE (as well as for the peculiar spectrum). H. Brysk presented calculations showing that destructive interference in RaE entails constructive interference in Tl^{206} and, indeed, the latter element has the shorter life expected from this. Nordheim showed that the observed once-forbidden transitions with no spin change are faster than those with a change of spin. This added speed can be attributed to the pseudoscalar component, which acts in once-forbidden transitions only when there is no change of spin.

4) L. Langer described a measurement of an electron spectrum (distribution in energy) which, if correctly interpreted, may lend support to Konopinski and Mahmoud's interpretation of once-forbidden transitions (2). However, this measurement (Sb^{124}) is complicated by disagreements about the gamma rays emitted with the beta particles. E. Tomlinson includes two 700-kv gamma rays in his decay scheme for Sb^{124} , whereas Langer has evidence for only one. F. Metzger reported gamma-gamma coincidence measurements in support of Tomlinson's scheme.

5) Konopinski further discussed the results of carrying over the beta decay law, in the form found, to the decay of muons. He first presented theoretical arguments that the two neutral particles ejected in muon decay are like neutrinos. The result is a prediction of an ejected electron energy distribution which agrees with some of the mutually contradictory measurements (those finding the fewest high-energy electrons).

Discussions of the Laws of Gamma Radiation. Unlike the laws of beta radiation, the basic laws of electromagnetic radiations are well known. The problems arise in the attempts to apply them correctly. When the nucleus is regarded as a classical distribution of charges and currents, then certain expectations arise: radiations which carry off the more angular momenta

should be the weaker; the magnetic type of radiation is expected to be only as strong as the electric type which carries off one more unit of angular momentum. In more realistic pictures of nuclei, the classical relation between electric and magnetic radiations is lost; this is to be expected, for example, when one considers the extra contributions to magnetic radiation to be expected from the intrinsic magnetic moments of individual nucleons. One has well-defined expectations only when the radiation is attributed to transitions between single particle states. Hence the comparisons with the facts are usually made against the single particle model.

1) A. Sunyar demonstrated that the single particle expectations greatly overestimate the rate of electric dipole radiation (the electric type which carries off one unit of angular momentum). To do this, he identified nine transitions, of the type in question, which follow after beta decay.

2) Goldhaber pointed out that magnetic gamma radiations are an approximately constant factor weaker than as predicted by the single particle model. Their variation with energy closely parallels that of the model. On the other hand, the electric types of radiation vary erratically. This has consequences for the mixtures of electric and magnetic radiations which may occur. Most often, both types are about equally strong when they have the same multipolarity (dipole, quadrupole, etc., an index of the maximum angular momentum carried off). This accounts for the comparative rarity of mixtures, since both cannot occur in a given transition when they have the same multipole character. However, because of the erratic behavior of the electric intensities, some mixtures do occur. Sometimes the classical expectations of an electric multipole mixture with the next lower magnetic multipole occurs. More recent is the finding that also, in some cases, the electric multipole is mixed with the next higher magnetic multipole.

3) Mihelich described a neat experimental method for comparing multiplicities. He compares the efficiency with which the gamma rays kick out atomic electrons from two types of orbits (L_I against L_{II}, III). The ratio of ejections from one type of orbit to the other is small for electric quadrupole radiation, large for magnetic dipole radiations. A ratio approaching unity is a sensitive indication that the gamma radiation is a mixture of the two kinds.

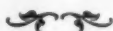
A conspicuous example of the refinements being achieved in nuclear spectroscopy are the measurements of directional correlations between successive radiations.

4) R. Steffen described experiments on the directional correlation of successive gamma radiations. This turns out to be very sensitive to small degrees of mixing of the radiations. He found examples of both the types mentioned by Goldhaber (2). He stressed that the strong admixture of electric quadrupole radiation with magnetic dipole is evidence of core excitation, as discussed by Ford.

5) M. Rose suggested a means of avoiding one difficulty which besets the correlation of successive radiations. The difficulty is that the nucleus may be randomly disoriented by external effects in the stage between the successive radiations. He suggests using the ratio of the gamma-gamma correlations, to correlations between one gamma ray and an atomic electron kicked out by the second. Both types of correlations are identically affected by the nuclear disorientation.

6) Rose also discussed the very sensitive method of correlating the *direction* of one gamma ray with the *polarization* orientation of the other. He laid down the general rules for interpreting such measurements.

A more comprehensive report of the above proceedings has been prepared. A limited number of copies are available at the Indiana University Physics Department.



Walter T. Swingle: 1871—1952

William Seifriz

Botanical Laboratory, University of Pennsylvania, Philadelphia

WALTER T. SWINGLE was one of the most inspiring men who ever entered my life, and the lives of many others. Personally, I owe to him my first lesson in botany at the age of 7, my first job, in the Department of Agriculture, at the age of 17, and my first knowledge of the fact that science is more than experimentation.

David Fairchild recently reminded me of the little intellectual sanctuary which I claimed as my own, beneath the seminar table in my childhood home. There, ensconced, refusing to come out at my mother's command, I heard Dr. Swingle tell of the date palm which he hoped to introduce into America, and later did; of the Chinese trifoliate orange which he thought would be excellent stock for the grafting of the sweet orange, as it was; of the mangosteen, "fruit of the gods" he called it; and I took a solemn vow to taste of it, and 40 years later did so; of Java coffee, Egyptian cotton, and bacteria—for Swingle was as much a plant pathologist as he was a horticulturist. The discussions at the seminar table under which I sat had often to do with plant diseases, Merton White taking the side of the fungi and Erwin Smith holding out for the bacteria, the argument having to do with the cause of pear blight. "Willie," Dr. Swingle said to me, "every particle of dust in the air is covered with bacteria." Dr. Fairchild has said that he, too, first heard of bacteria from Dr. Swingle. The isolation of anthrax and immunity through inoculation had been accomplished only ten years previously by Pasteur. What, I am sure, was the first culture transfer room ever to be constructed in America was made by Swingle and Fairchild in 1890 at the Kansas State Agricultural College, where they were students together. It was an old piano box lined with cotton cloth soaked in a solution of corrosive sublimate. Into this supposedly septic box these two alternately crawled.

Among his many plant interests those of the orange and the date occupied most of Swingle's time. I recall with pleasure one citrus hybrid, the citrange, for I was then the only American boy who had had citrange-ade. The citrange was a cross between the sweet orange and the trifoliate orange. Better known is the hybrid between the tangerine and the grapefruit, which yielded the tangelo, now extensively grown in Florida. It should be remembered that in Swingle's earliest years the orange, date, and fig were mere names in America. In writing to Fairchild from Florida about 1892, Swingle described the orange tree as "something like an oak with bright yellow fruits hanging from its branches." Swingle's work on citrus not only took him on many long journeys in the Orient, but on another pleasant journey, that of marriage with Maude Kellerman, who had demonstrated the practicability of keeping pollen viable long enough to ship halfway around the world (before the days of air mail!), thus bridging the time between flowering periods of different species.

Swingle's work with the date and his treatise on date culture, which is a classic, have so overshadowed his other work that most of it is unknown except to his closest friends. His comparative studies in ecology in Algeria, Arizona, and California, and his introduction of the fig insect, *Blastophaga*, from Algeria into California, which made possible the successful culture of the Smyrna fig, are widely known, but who has heard of his interest in optics which resulted in his persuading Zeiss to make a lens of diamond based solely on Swingle's calculations? And who knows of his work in ultraviolet photography, in which I had a hand? He had me set up a complete equipment of which the cytologist, Yamaguchi, was to have charge, but Yamaguchi never got farther east than Chamberlain's laboratory in Chicago.

Swingle saw the applicability of every brand of science that would conceivably throw light on a bio-

logical problem. The mitotic figure in dividing cells he thought might be a magnetic field. Today we still recognize the superficial resemblance. And so he persuaded Lyman J. Briggs to join him in subjecting dividing animal eggs to a high electromagnetic field. Swingle had the rare quality of giving a research problem to others if he thought they would do it better. He sent me to work with Dr. Briggs so that the findings of Sir Oliver Lodge could be tested. Lodge claimed a great increase in yield from plants subjected to high-voltage static electricity. During three years we stimulated everything, but only Dr. Briggs and a government mule were visibly affected.

The amount of work that Swingle accomplished was phenomenal. One of his undertakings has resulted in the Library of Congress possessing the largest and richest collection of Chinese books outside the Orient. This one activity alone, involving the acquisition of over 100,000 volumes and the active participation of ambassadors, ministers, eminent orientalists, and the Empress Dowager of China, would have been a lifetime occupation for the average scholar but was merely incidental to Swingle's major work.

I presume the world at large will remember him because of his contributions to science and oriental literature, but for me he will always remain what the Germans call "ein grosser Geist"—greater than a scholar and more human than a genius. Swingle managed to convey not only the joy of scientific research but also the mental satisfaction to be derived from pure observation. As Swingle said many years ago, "Look and look again and again. Experiments are not necessary in order to learn, and experimental work without observation can leave one woefully ignorant."

He would not have studied the chromosome picture of a plant, or have cross-pollinated it, or isolated a protein from it, or have analyzed the soil where it grows, without first knowing the plant. He was the very antithesis of the "uneducated expert."

So brimful of ideas was he that at the Department of Agriculture it was said, "As long as Swingle is here, there will be no dearth of ideas." Though he was creative by nature, I believe his years in Europe helped for they made a lasting impression. He spent a year with Strassburger at Bonn in 1895 and a year

with Pfeffer at Leipzig in 1897. His association with Strassburger resulted in work at the Naples Marine Laboratory and the publication, with Strassburger, Fairchild, and others, of articles which filled an entire volume of Pringheim's *Jahrbücher für wissenschaftliche Botanik*. He never lost contact with European and North African laboratories and experimental stations.

Much is said these days about the integration of knowledge, and much is attempted in the way of international good will through mutual scientific interests. I have been associated with several such undertakings and have wondered if Swingle did not embody the qualities necessary for them to a greater degree than any two dozen men who have attempted to achieve them. He knew the meaning of intellectual good will. He was of an affectionate nature and felt deeply and warmly toward all people, and he often assumed their welfare to be a personal responsibility. To meet him was a delightful experience. He made you feel as if you were the only person in the world who mattered at the moment, and he meant it. His concern for others was often dramatic in its intensity. He once told me that, given the chance, he could save China from famine. He had developed a drought-resistant cereal, which, he said, would grow on upland Chinese deserts. The Department of Agriculture was often put to it to decide whether to hold Swingle's enthusiasm in check or let him have his way at the risk of a fiasco. Few things annoyed me more in connection with the Department than this check on him. For me he was the Department of Agriculture, and those who kept him in check are today unknown.

To be told when and where he was born, at Canaan, Pennsylvania, in 1871, and when and where he died, January 1952, in Washington, D. C., is of less importance than to know that he lived and inspired more agricultural botanists than any other one man. To have known him as a man and as a scientist was a great privilege. He was as kindly as he was brilliant. I never saw a photograph that did not show him with a smile and a little twinkle in his eye. It's good that he lived when he did, when the world of science needed men of his enthusiasm. The present Department of Agriculture and the world at large are foreign to his temperament. More callous characters than his are needed to cope with those forces which hold so many in check today.



News and Notes

Summer Conference on College Biology

THE Summer Conference on College Biology was held at the University of Oklahoma, June 15-19, under a grant from the National Science Foundation. More than 50 invited participants represented 32 colleges and universities from Oklahoma, Texas, Arkansas, Kansas, Missouri, Colorado, Arizona, Louisiana, and Illinois.

The conference was organized to discuss improvement and modernization of the content of introductory college biology courses on the premise that new research findings and concepts must be assimilated and integrated if such courses are to serve most effectively the purpose of biology in general and the needs of future professional scientists.

The conference sessions were organized about the common topic, "What are the materials from modern . . . (e.g., embryology) which should be included in introductory college biology courses? How are these materials related to, how do they contribute to, and how do they depend upon, comprehension of other fields?" The fields that were discussed were selected to present the broadest possible cross-section of biology and related disciplines.

The session speakers, chosen for their interest in introductory courses as well as in active research, were: embryology, J. H. Bodine, University of Iowa; physiology and biochemistry, Florence Moog, Washington University; biophysics, David Pomeroy, Army Medical Research Laboratory, Fort Knox; bacteriology, Orville Wyss, University of Texas; genetics and evolution, L. J. Stadler, University of Missouri; taxonomy, Joseph Ewan, Tulane University; histology, histochemistry, and cytochemistry, Howard C. Hopps, University of Oklahoma Medical School; and ecology, Charles E. Olmsted, University of Chicago.

The introductory address was made by Harry C. Kelly, Assistant Director for Scientific Personnel and Education, National Science Foundation. Ralph W. Gerard, University of Illinois Neuropsychiatric Institute, gave the major address of the conference. The concluding and summarizing paper was given by Paul R. David, University of Oklahoma.

The following paragraphs are largely abstracted from the paper read by Paul R. David and are given without attempt to credit the author or authors.

1. Biology, in general, is failing to attract the best students and, furthermore, is held in a position of low esteem by laymen. This may be due in part to introductory courses that present biology as a body of doctrine and not as a study of dynamic phenomena that have inherent within them the most fascinating and important problems of the universe.

2. Recognizing that biology courses are failing to meet the objectives set for them, there is need for serious re-evaluation of materials and organization of the courses. The facts that are presented need to be

selected carefully so that they will best illustrate causal relationships and thus present the dynamic or cause-and-effect viewpoint that is desired.

3. Although biology is compartmentalized into various fields, e.g., genetics, comparative anatomy, bacteriology, for convenience, these are artificial barriers. A real effort must be made to present living organisms as products of their evolution, heredity, physiology, anatomy, ecology, and behavior, if biology is not to be sadly and severely misrepresented.

4. There must be no separation of structure and function in the study of living organisms, but structure and function must be presented as inescapably dependent upon each other.

5. The use of a dynamic descriptive approach to biology will entail constant understanding and employment of the scientific method. From this will accrue an appreciation of the theoretical aspects of biology and a way of thinking that is an absolute requirement in our society today if our lives and our civilization are to be ruled by reason rather than by superstition, prejudice, or self-interest.

Although these five ideas have been stated many times before, their constant reiteration indicates that they have not yet been incorporated successfully into the majority of introductory college biology courses and that this incorporation is necessary if such courses are to fulfill their purpose.

Complete proceedings of the conference will be published.

HARRIET HARVEY

Department of Zoological Sciences
The University of Oklahoma

Scientists in the News

Emil Artin, mathematician, and Hadley Cantril, psychologist, have been appointed to two of Princeton University's oldest endowed chairs. Dr. Artin has been made Henry Burchard Fine Professor of Mathematics, and Dr. Cantril, Director of the Office of Opinion Research, is Stuart Professor of Psychology. Recently named Chairman of the Department, Dr. Cantril has had a major role in the development of a series of demonstrations in social psychology.

Pearce Bailey, Clinical Professor of Neurology at the Georgetown University School of Medicine, has been made President of the American League against Epilepsy. He succeeds Francis M. Forster, Dean of the Georgetown medical school.

Stanley S. Ballard, Professor and Chairman of the Department of Physics at Tufts College, has been granted a leave of absence for the coming academic year. He will spend this period as a member of the Electronics Division of the Rand Corporation, Santa Monica, Calif.

Jorgen M. Birkeland, Professor and Chairman of the Department of Bacteriology at Ohio State University, has been given a leave of absence to serve as Science Attaché in the American Embassy at Stockholm. This assignment represents further progress in carrying out the recommendations of the report, *Science and Foreign Relations*, adopted by the State Department in 1950. Included in that report was a proposal for the establishment of an Office of Science Advisor in the State Department and of science attaché posts in important American missions abroad. Dr. Birkeland will replace **Harald H. Nielsen**, Ohio State University physicist who will return to his university this autumn.

M. C. Brockmann, formerly senior scientist for Kingan & Co., Indianapolis, has been appointed Director of Research.

Louis Costrell, who has been associated with the National Bureau of Standards since 1946, has been appointed Chief of the Nucleonic Instrumentation Section.

Hidden T. Cox, formerly Associate Professor of Botany at the Virginia Polytechnic Institute, has been appointed to the newly created post of Deputy Executive Director of the American Institute of Biological Sciences, Washington, D. C. On the faculty of the Institute since 1949, he has also taught at Howard College, Agnes Scott College, and the Mountain Lake Biological Station of the University of Virginia. As Head of the Botany Section of the Department of Biology at V.P.I., Dr. Cox has added administrative experience to his background of teaching and research.

Robert Davies, formerly an Associate Engineer with the Rand Corporation, Santa Monica, is Senior Research Engineer at the General Motors Research Laboratories, Detroit.

Victor H. Dropkin, formerly of the Naval Medical Research Institute, has been appointed Associate Nematologist in the Division of Nematology Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering. His first assignment is at Beltsville, Md.

Nicholas D. Duffett has recently been appointed Director of Public Health Laboratories of the St. Louis Health Department. Dr. Duffett has been with the Laboratory Section since 1944, first as Principal Bacteriologist and since 1948 as Assistant Director. He succeeds the late **Joseph C. Willett** who established the public health laboratory 32 years ago.

R. L. Ely, recently of the U. S. Air Force, is an engineer at The Johns Hopkins University Applied Physics Laboratory, Silver Spring, Md.

William L. Everitt, Dean of the College of Engineering, University of Illinois, is the recipient of the Institute of Radio Engineers' Medal of Honor for 1954, the highest technical award of the radio engi-

neering profession. The Institute gave the award "for his distinguished career as author, educator, and scientist; for his contributions in establishing electronics and communications as a major branch of electrical engineering; for his unselfish service to his country; for his leadership in the affairs of the Institute of Radio Engineers."

Carlos Luis Gonzalez, Director of Public Health of Venezuela, has been appointed Chief of the Division of Public Health, Pan American Sanitary Bureau, Regional Office, World Health Organization, Washington, D. C.

H. E. H. Greenleaf, Professor of Mathematics, DePauw University, has been made Head of the Department of Mathematics.

Edward G. High has resigned from the staff of the Department of Chemistry at Prairie View A. & M. College, Prairie View, Tex., to accept the position of Associate Professor of Biochemistry at Meharry Medical College, Nashville, Tenn.

Klaus Hofmann, formerly Research Professor of Chemistry, has been appointed Professor of Biochemistry and Chairman of the Biochemistry Department in the School of Medicine, University of Pittsburgh.

Paul L. Salzberg, Assistant Director of the Chemical Department of the Du Pont Company, Wilmington, has been made Director. He succeeds **Cole Coolidge**, who died recently.

Ralph E. Snyder, Assistant Dean of New York Medical College since 1951, has been appointed Executive Dean. He succeeds **J. A. W. Hetrick**, who will continue as President of the college.

George Dinsmore Stoddard, psychologist and President of the University of Illinois has resigned, effective August 31st, as the result of a 6 to 3 vote of "no confidence" by the university's board of trustees. Harold E. Grange, Illinois football star of the 1920's, was the board member who asked for the confidence vote. Twenty department heads, and two professors acting in the absence of their superiors, joined together in condemning the action of the board. They issued a statement in the form of a letter addressed to Dr. Stoddard and to Coleman R. Griffith, university provost who also received a no confidence vote. The group thanked Dr. Stoddard for his "stand for honesty in science and integrity in education" and described him as "a man of progressive programs and ideas." The letter went on to say, "Always we have had freedom to speak our opinions without fear and without intimidation," and further added: "We wish also to tell you that we consider the action of the trustees in forcing your resignation contrary to all accepted standards of academic procedure. Technically legal, it is morally unjust."

Gov. William G. Stratford was asked if he could

state specifically what disagreements led to the decision by the board of trustees. He replied: "There was a series of incidents over a period of years. It was getting to be a difficult picture there at the university, and it apparently was felt by the board of trustees that it would be better to have a president with whom it had a better working relationship. There was a feeling on the part of the board that it would be better to have someone less controversial toward the Legislature and the public. The Board sets the policy for the university. The trustees have felt that Dr. Stoddard was attempting to originate policy, instead of its coming from them."

Park Livingston, chairman of the board of trustees, listed 14 charges against Dr. Stoddard on which the board had based its vote. In response, Dr. Stoddard issued a point by point rebuttal, defending his action in every case and terming some of the charges completely false.

The most acutely controversial issue was that concerning Krebiozen. Andrew C. Ivy, Vice President of the university and Head of the Department of Clinical Science, had been conducting research on and promoting the application of a new secret drug known as Krebiozen, which was said to have curative properties in the treatment of cancer. Failure to disclose the nature of the drug led to Dr. Ivy's suspension from the Chicago Medical Society. The American Medical Association reported unfavorably on Krebiozen, as did the American Cancer Society. Dr. Stoddard banned further research with the material and arranged that Dr. Ivy take a leave of absence.

In his official statement concerning Dr. Stoddard's resignation, Mr. Livingston stressed that the resignation had not resulted from the issue between Dr. Stoddard and Dr. Ivy. Dr. Ivy has since returned to his post as Head of the Department of Clinical Science and has been named Distinguished Professor of Physiology. He has resumed his work with Krebiozen.

Before assuming the presidency of Illinois in 1946, Dr. Stoddard was N. Y. State Commissioner of Education and President of the University of the State of New York. In recent years he has participated in many significant educational activities. He was chairman of the U. S. Education Mission to Japan which overhauled the Japanese school system, and he has been chairman of the American Council on Education as well as a member of the President's Commission on Higher Education. He was a leader in the formation of the United Nations Educational, Scientific and Cultural Organization, with which he has been associated in various capacities, including that of U. S. member of the executive board. He was a delegate to the UNESCO conferences in the years 1946-1948.

Education

The Chemical Education Committee of the Philadelphia Section of the **American Chemical Society** will present two Continuation Courses, "Pharmacology

of the Nervous System" and "The Objective Specification of Color and Color Differences," during the fall. Detailed information may be obtained from Dr. E. R. Nixon, Harrison Laboratory, University of Pennsylvania, Philadelphia 4, Pa.

The **American Society for Metals** has just completed the second Metals Technology teacher training course at Fitchburg, Mass. The State of Massachusetts, working in cooperation with the ASM, is the second state to offer a course in Metals Technology for vocational and technical high school teachers. The first training course of this type was completed in June at Oswego State Teachers College, Oswego, N.Y. Twenty-eight men out of the 41 teachers who attended the Fitchburg session sought credit for professional development and took formal examination after completing the course.

The Department of Mathematics, **DePaul University**, Chicago, is inaugurating a new program of studies in mathematics intermediate to the Master's degree and the Ph.D. degree. Students completing this program of study will be granted a certificate designating them as Mathematics Specialists. Requirements include 48 semester hours of graduate work in mathematics, a reading knowledge of French, German, or Italian, a comprehensive written examination, and the completion of an oral examination.

The former **Kaiser Wilhelm Institutes and Research Centers** which, after 1945, had been organized within the Deutsche Forschungshochschule Berlin-Dahlem, have become part of the Max-Planck-Gesellschaft under the name of Max-Planck-Institute und Forschungsstellen. The Deutsche Forschungshochschule has been dissolved.

The series of basic courses in the techniques of using radiosotopes in research continues to be offered at regular intervals by the Special Training Division of the **Oak Ridge Institute of Nuclear Studies**. Starting dates of the next three courses are January 4, February 8, and March 15, 1954. Applications and supporting letters must be received *three months* in advance of the starting date.

The courses are offered to enable mature research personnel to obtain in a short time (4 weeks) sufficient facility in the use of radiosotopes to apply them safely and efficiently to their own research problems. Since the demand for this type of training exceeds the facilities for supplying it, the course is designed for university faculty members, group leaders of research teams, and other individuals who will impart the training to additional persons. Applications and additional information may be obtained from the Special Training Division, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tenn.

St. John's University, Brooklyn, has announced the extension of the curriculum of the Department of Biology to permit study for the Ph.D. degree. Six new courses have been added to the department to

provide the necessary extra course material for doctoral candidates. The new doctoral program is open to qualified students in the fields of physiology, parasitology, and zoology.

Within 3 to 5 years the **Stanford University Medical School** will be moved from San Francisco to more adequate quarters in Palo Alto.

The **University of Hawaii** has recently authorized its Botany Department to offer a course of studies leading to the Ph.D. degree. Instructors for the program will be H. St. John, M. L. Lohman, E. J. Britten, M. S. Doty, B. J. Cooil, and K. Shoji.

New four-year undergraduate programs leading to the B.S. degree in fisheries technology and in food management will be set up at the **University of Massachusetts** this fall. Both curricula will be administered by the Food Technology Department, headed by Carl R. Fellers. The food management course will be separate from a two-year non-degree course now offered by the same department.

The fisheries technology program is being offered in response to urging by civic, industrial, and educational agencies in New England seaboard cities. At present, the only fisheries school in the U. S. is located on the west coast at the University of Washington.

Grants and Fellowships

The **Beckman Award**, an award honoring U.S. and Canadian scientists for work in chemical instrumentation, has been established by Arnold O. Beckman, Beckman Instruments, Inc., South Pasadena, Calif. To be presented first in the spring of 1955, the \$1,000 annual prize will recognize outstanding achievements in the development of new instruments for chemical analysis and the application of instruments to chemical process measurement and control.

Administered by the American Chemical Society, the Beckman Award will give special consideration to originality as well as the value of the contribution in reducing manufacturing costs or improving product quality. Purpose of the award is twofold: to stimulate research in analytical instrumentation, and to encourage development of instrumental methods for measuring and controlling chemical processes.

Four research bacteriologists who carried on a ten-year search for a series of new antibiotics known as the Pyos (*Pseudomonas aeruginosa*) have received the 1952 **Commercial Solvents Award in Antibiotics**. The award, which consists of a gold medal, \$1,000, and engraved scrolls, was presented to Ibert C. Wells, Syracuse, N. Y.; Edwin E. Hays, Chicago, Ill.; E. A. Doisy, St. Louis, Mo.; and William L. Gaby, Philadelphia, Pa. The group was selected for the honor by the Commercial Solvents Award Committee of the Society of American Bacteriologists for research started at St. Louis University in the early days of World War II.

Their work was begun prior to 1945, in which year their first publication appeared, and reached its fruition with the proof of structures in 1952. These workers have demonstrated that, in addition to pyocyanine, one of the earliest known antibiotics, *Pseudomonas aeruginosa* produces several other antibacterial agents; they have worked out methods of isolation, separation, and purification of these agents, defined their physical and chemical properties, proposed structural formulae for them and, by degradation and synthesis, proved the acceptability of the proposed formulae.

The Committee on International Exchange of Persons, Conference Board of Associated Research Councils, 2101 Constitution Avenue, N.W., Washington, D. C., has announced the 1954-55 **Fulbright Awards** for university lecturing and advanced research in Europe, the Near East, Japan, and Pakistan. Application forms are obtainable only upon individual request to the Conference Board Committee, and completed forms should be returned to the Committee. All persons requesting application forms are provided with a copy of the booklet, "U.S. Government Awards under the Fulbright Act," which contains detailed information on terms of awards, eligibility, and application and selection procedures. The closing date for making application for any of the programs listed is October 15, 1953.

The **Heineman Foundation for Research, Educational, Charitable and Scientific Purposes, Inc.** has announced the establishment of the **Dannie Heineman Prize**. This prize of \$5,000 is to be awarded every 3 years to the author of an outstanding book or manuscript in the mathematical or physical sciences. The object of the prize is to encourage the writing of books on a high scientific level which have merits of exposition and which are likely to facilitate access to important fields of research. Submissions for the next award must be made not later than Dec. 31, 1955. Further information may be obtained from the Secretary of the Foundation, 50 Broadway, New York 4.

Announcement has been made of the **Louis Lipsky Exchange Fellowships in the Natural Sciences**. These fellowships are intended to promote fundamental research in the natural sciences at the Weizmann Institute of Science at Rehovoth, Israel. They are awarded as a rule to persons who will have met all of the requirements for the doctor's degree before assuming their fellowships.

The basic stipend is \$3,600 per annum, plus travel to the place of study. Larger stipends will be granted to senior investigators. Appointments are for one year. In special cases appointments can be made for a lesser period. The closing date for receipt of applications for 1954-1955 will be Oct. 15, 1953. Awards will be made about December 1, 1953. Detailed information may be obtained from Dr. D. Rittenberg, College of Physicians and Surgeons, 630 W. 168 St., New York 32, N. Y.

Meetings and Elections

The largest meeting of surgeons in the world, the 39th Annual Clinical Congress of the **American College of Surgeons**, will be held in Chicago, Oct. 5-9. More than 11,000 surgeons, physicians, and others will attend to participate in postgraduate courses, forums, symposia, panel discussions, color television programs, medical motion pictures, ciné clinics, and exhibits, all concerned with developments in surgery.

The **American Institute of Nutrition**, a new affiliate of the AAAS, was provisionally incorporated on Sept. 27, 1928, and officially organized on April 10, 1933, as an educational institution for the dissemination of scientific knowledge regarding the chemistry and physiology of nutrition and for promoting research in the field of nutrition. The Institute sponsors the monthly publication, the *Journal of Nutrition*. The present membership totals 410. The following officers have been elected for 1953-54: pres., Conrad A. Elvehjem, University of Wisconsin; v. pres., George R. Cowgill, Yale University; sec., James M. Orten, Wayne University College of Medicine; treas., O. L. Kline, U.S. Food and Drug Administration, Washington, D. C. Representatives to the AAAS Council are Joseph H. Roe, George Washington University School of Medicine, Washington, D. C., and Fredrick J. Stare, Harvard School of Public Health.

News of latest developments aimed at preventing disease and promoting personal and public health will be exchanged by professional workers from all parts of the free world at the 81st annual meeting of the **American Public Health Association** and annual sessions of 40 related organizations at the Hotels Statler and New Yorker, New York City, November 9-13. More than 5,000 public health workers—physicians, dentists, nurses, engineers, statisticians, veterinarians, sanitarians, nutritionists, health educators, entomologists, biologists and others—are expected to attend the sessions. Theme of the meetings will be "Meeting the Health Needs of the Community."

The **Association of Official Seed Analysts** has elected the following officers for 1953-54: pres., Duane Isely, Iowa State College; v. pres., Buford Jones, State Seed Laboratory, State Dept. of Agriculture, Oklahoma City; sec.-treas., R. G. Colborn, Nebraska Dept. of Agriculture, Lincoln, Neb.

The **Southwestern Association of Naturalists** was formed at an organizational meeting attended by 52 persons at the University of Oklahoma Biological Station at Lake Texoma on May 23, 1953. As stated in the constitution, "The object of the Association shall be to promote the field study of plants and animals, living and fossil, in the Southwestern United States and Mexico, and to aid the scientific activities of its members." SWAN hopes to stimulate the study of the region by bringing together persons of like interests through publication of annotated member-

ship lists, annual meetings, and perhaps later through the publication of a journal.

The officers elected for the first year were: pres., W. Frank Blair (Vertebrate Zoology), University of Texas; v. pres., George J. Goodman (Plant Taxonomy), University of Oklahoma; and sec.-treas., Herndon G. Dowling (Herpetology), University of Arkansas. The geographic scope of the Association at present includes Mexico and the states of Arizona, Arkansas, Kansas, Louisiana, New Mexico, Oklahoma, and Texas. Persons interested in the natural history of this region are invited to join the Association. Membership blanks may be obtained from any of the officers.

Miscellaneous

The **Bureau of Medicine and Surgery**, Department of the Navy, Washington, D. C., has begun limited distribution of a 235-page volume listing names and activities of medical department personnel in World War II who became casualties or who were decorated.

The **Mental Health Bell**, a bell cast from shackles once used to restrain mental patients, has been awarded to the Baltimore Sunpapers for their "outstanding service in the fight against mental illness." The award was made by George S. Stevenson, Medical Director of the National Association for Mental Health, Inc. The bell will be kept on display until Mental Health Week, 1954, when it will be presented to the newspaper, magazine, radio or television chain or station which will have done most to advance mental health in the preceding year. The award to the Sunpapers was based on their five-year crusade for improvement of Maryland's mental hospitals, which resulted in the operating budget being tripled and \$20,000,000 being appropriated for hospital construction.

The **National Issues Committee**, whose organization was announced recently by Mrs. Eleanor Roosevelt, will work for progressive national health legislation, among other objectives.

A group of scientists left recently for the North Geomagnetic Pole, where they will make a comprehensive series of high altitude observations of the primary cosmic radiation in northern latitudes. In addition they will also study the temperature and density of the atmosphere at extreme altitudes. Named "Project Mushrat," the expedition is sponsored by the Bureau of Aeronautics, the Office of Naval Research, and the Atomic Energy Commission. Instruments will be carried above 100,000 feet by balloon-launched "Deacon" rockets, which during a similar expedition last year climbed to a peak altitude of 295,000 feet. Participating in the research project are scientists, chiefly physicists, from the Office of Naval Research, the State University of Iowa, New York University, and the Aeronautical Research Laboratories, General Mills, Inc., Minneapolis.

Technical Papers

Preliminary Observations on Intraspecific Variation of the Levels of Total Protein in the Sera of Some Decapod Crustacea¹

Charles A. Leone

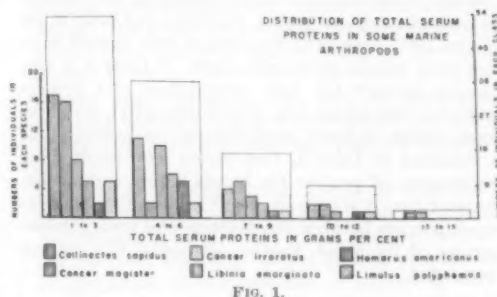
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The total protein found in the sera of decapod Crustacea may vary from 0.5 g % in one species to 8 g % in another (1-3). Little information is available on the variation which may normally occur within a single species. Values among individuals of the same species that differ by as much as 3 g % have been reported (3-5). Since hemocyanins constitute virtually all the protein in crustacean sera (6-8), a recent paper (9) listing a broad range of values for the content of copper in the blood of the Australian marine crayfish, *Panulirus longipes* Milne-Edwards, might indicate that widely variable amounts of total protein could likewise be expected to occur.

TABLE 1
NORMAL RANGE OF TOTAL PROTEIN IN THE
SERA OF DECAPOD CRUSTACEA

Species	Common name	No. of individuals	Range g/100 ml	Mean g/100 ml
Crustacea				
<i>Callinectes sapidus</i>	Blue crab	31	1.83-12.00	4.39
Rathbun				
<i>Cancer magister</i>	Edible crab	26	1.16-13.75	4.45
Dana				
<i>Cancer irroratus</i>	Rock crab	10	1.75-11.45	5.39
Say				
<i>Libinia emarginata</i>	Spider crab	12	0.73- 7.25	4.14
Leach				
<i>Homarus americanus</i> Milne-Edwards	Lobster	9	2.20-10.20	4.28
Arachnida				
<i>Limulus polyphemus</i> Linnaeus	King crab	23	0.77-13.45	5.92

Table 1 presents data on the total protein in the sera of several species of decapod Crustacea and one species of Arachnida. The range for each species is remarkable. *Cancer magister*, for example, has values which extend from 1.16 to 13.75 g %. This is a considerably wider range than has been previously re-



ported for a single species; it also exceeds the cited ranges of values among different species. From the information in the table it appears that broad ranges are normal for species of decapod Crustacea and the marine arachnid *Limulus* (= *Xiphosura*) *polyphemus*. In general, the localities from which each species was collected were quite restricted and the number of individuals listed can properly be regarded as part of a single population for that species. *Limulus* is an exception in that these individuals were assembled from three widely separated localities (Massachusetts, New Jersey, and North Carolina). The small numbers of individuals listed for *Cancer irroratus*, *Libinia*, and *Homarus* were necessary in order to be reasonably sure that a single population was represented for each of these species. The ranges for these three species increased when the values (not included in the table) for the total protein from individuals collected at different times and other localities were added to the numbers representing the species. The sizes of the individuals within each species were variable, but no immature or small organisms were included in the comparisons. It is my conviction that the wide range of values presented for each species in Table 1 may normally be expected to occur in a natural population, at any given time.

The arrangement of the values for the total serum proteins for each species is not a normal frequency distribution. An evaluation of the collective data reveals a continuous distribution over the entire range. By arbitrarily establishing class values of 2 ± 0.5 g % of protein, and by classifying all the individuals accordingly, the class of lowest values, $1-3 \pm 0.5$ g %, includes the most individuals and the class of highest values, $13-15 \pm 0.5$ g % has the least (Fig. 1).

The amount of protein in the sera of the brachyurans *Cancer magister* and *Callinectes sapidus* appears to be crudely correlated with the stages of the molting process. Papershell crabs generally had the lower values; thin hardshell crabs had the middle values; thick hardshell and peelers had the highest values. The level of the total protein in the sera of softshell crabs was more variable than for the other

¹Aided by a contract between the Office of Naval Research, Department of the Navy and Nonr 58303.

kinds of crabs. Observations similar to these were not made for the other species. More precise studies are indicated.

Much physiological data pertaining to the concentrations of inorganic ions in the blood and body fluids of Crustacea have been established from pooled samples from two or more individuals. If there is a correlation between the ionic composition and protein content of the blood (2), and if the latter varies as much, under uniform conditions of environment, as is indicated in Table 1, then errors may result from the practice of pooling the bloods before making determinations. It is entirely possible, also, that no relationship exists between the proteins and ionic concentrations of the blood. Further studies on this subject are needed.

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Occlusion of Copper and Zinc by Some Soil Materials of Lower Mississippi River Area¹

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This preliminary note reporting a selective occlusion of small amounts of copper and zinc by some Mississippi River materials and by some soils derived from them is a part of a detailed report now in preparation. Observations on the occlusion of copper and zinc are parts of a general study of geochemistry of archaeological sites. The study itself was undertaken as a search for the means, the methodology, whereby the knowledge of weathering phenomena could be brought to bear on archaeological-anthropological problems, specifically, on the physical-chemical history of archaeological terrains.

Field indications and experimental evidence suggest existence of mechanisms in soil materials, soils, and parts of some soil profiles that are capable of occluding rather than exchanging very small amounts of copper and zinc, singly or in the presence of each other, under certain conditions. Such mechanisms exist

in some but not in all of the materials examined. Their presence or absence may be correlated with origin and extent of weathering of the materials or horizons. The number of comparisons made so far is only 75 and, obviously, far more work is needed to ascertain the correlations and to identify the occluding mechanisms. The results obtained to date are so consistent, however, and the test employed is so simple and clearcut, that a preliminary note here presented appears to be permissible and, indeed, desirable.

A soil material shaken with a solution containing as much as 20 ppm Cu or Zn, singly or in the presence of each other, at the terminal pH from 5 to 8, responds generally in one of the following three ways: (a) both Cu and Zn are withdrawn from the aqueous phase quantitatively, (b) Cu is withdrawn but Zn is not, or (c) neither Cu nor Zn is withdrawn.

Reactions (a) and (b) take place at ordinary temperatures, seem to be instantaneous, and are reversible on the acid side of pH 2. They are not influenced by Ca^{++} , Mg^{++} , Na^+ , Fe^{+++} , Cl^- , SO_4^{--} , HCO_3^- , CO_3^{--} , or NO_3^- , but are inhibited by citrate and, to a lesser extent, by tartrate and acetate. They are not affected by enriched bacterial or yeast growth on added sucrose or by the enrichment of denitrifying microorganisms. The occluding mechanisms are not impaired by prolonged heating of the soils in question at 300–400° and appear to be associated with the mineral rather than with the organic fraction of soils. The organic chelators or fixers of Cu and Zn were encountered only in some humous topsoil horizons but their study is outside the scope of this note.

The occlusion of Cu and Zn, in the amounts studied, is independent of their calcium carbonate content, or of the proportions of acid-soluble iron and possibly the entire iron group.²

Cu is occluded on the alkaline side of pH 4, and Zn on the alkaline side of pH 5.5 or so. The occlusion does not take place on the acid side of these ranges. On the alkaline side of about pH 8, the occlusion is obscured by other phenomena. Occluded Cu and Zn can be recovered quantitatively at pH 2, as a rule, and in still more acid solutions.

Soil materials that do not occlude Cu or Zn appear to be more kaolinized, on the whole, than the occluders of both Cu and Zn. However, a detailed study of the occluding factors still remains to be carried out, and it is not clear yet whether the factors or the surfaces in question are associated with certain series or species of the clay minerals. They may prove to be associated with simpler substances of colloidal dimensions, judging by the responses of some sands. The author regrets the unavailability of laboratory facilities for further work in this connection.

The only seemingly positive correlation between the occlusion response and the kind of occluding material

¹The studies here reported were made possible by two grants-in-aid from the Wenner Gren Foundation for Anthropological Research. This generous aid is most gratefully acknowledged.

²Freshly precipitated $\text{Fe}(\text{OH})_3$ occludes both Cu and Zn on the alkaline side of pH 4. Amounts of occluded or coprecipitated Cu and Zn increase at pH 5, 6, 7, and 8, under comparable conditions. Zn is occluded by $\text{Fe}(\text{OH})_3$ more readily than Cu. CaCO_3 added to lime-free nonoccluding materials seems to have no effect on the occlusion.

TABLE 1
OCCLUSION RESPONSE AND EXTRACTABLE COPPER AND ZINC IN LOUISIANA-MISSISSIPPI SOIL MATERIALS*

Occlusion response	Per cent of Materials Examined	Extractable Cu, ppm		Extractable Zn, ppm	
		Range	Average	Range	Average
a. Both Cu and Zn occluded in presence of each other	15	0-150	19	11-150	59
b. Cu occluded in presence of Zn; Zn not occluded in presence or in absence of Cu	40†	0-7	1	1-63	13
c. Neither Cu nor Zn occluded singly or in presence of each other	45	0-1	0.2	0-24	4

* The occlusion test consists of the following operations: (a) 50 g of air-dry soil shaken in a 200-ml stoppered bottle with 100 ml of a solution containing 20 ppm Cu⁺⁺ and 20 ppm Zn⁺⁺ in 0.01 N HCl and allowed to settle; (b) supernatant liquid is withdrawn, filtered, if necessary, and tested for Cu⁺⁺ and Zn⁺⁺ by the dithizone method. pH of the system is maintained between 5 and 7.5 by HCl or NH₄OH. The appropriate blanks are run concurrently. With soils occluding both Cu⁺⁺ and Zn⁺⁺, the blanks are scarcely required. Such soils, in fact, can be used to remove traces of the two metals from distilled water and reagents, including ammonia.

† One-fifth of these materials showed a small or a doubtful capacity to occlude Zn.

is shown in Table 1, and is as follows. The greater the amounts of HCl-extractable Cu and Zn in the soil, the more likely is the soil to occlude additional small amounts of Cu and Zn. This crude generalization suggests merely presence or absence of certain mechanisms responsible for the reaction. Quantitative studies of a "Cu-Zn capacity" or some such possible characterization of our materials are deferred. Empirically, however, the test has already shown some value in the field, as may be illustrated by a summary of Table 1.

In this table, materials believed to be representative of the area studied are grouped in three categories: (a) Occluders of both Cu and Zn, singly and in the presence of each other. These materials include freshly deposited Mississippi River sediments, some midden soils near Sicily Island, Louisiana, buried middens in the delta south of New Orleans, deeper horizons of natural levees at Mauvais Bois, Point au Chien, and Carlyle, La. Their texture ranges from silty sand to clay and their calcium carbonate content is highly variable. (b) Occluders of Cu but not of Zn. This prominent group contains mature loess profiles, to 100 in. depth or so, near Natchez, Miss., leached and unleached loess near Doloroso, Miss., some artificial levee horizons (in place for 75 years or so), and some topsoil horizons from Poverty Mound, in the Arkansas River area. Their texture and CaCO₃ range are like

those in the preceding group. (c) Occluders of neither Cu nor Zn. This most numerous group includes soil profiles on Red River deposits, degraded loess, "brown loam" soils on the older Pleistocene Mississippi River terrace, mature soils on the Prairie terrace (late Pleistocene), the lower Atchafayalla backswamp clay, materials from Teehe I channel, most of the Poverty Mound Traverse, leached clays near Sicily Island, La., profiles near Marksville, La., both on made ground and natural buried soil, and senile soils on early Pleistocene and pre-Pleistocene materials throughout the area.

It may be possible to make use of the occlusion test in the identification of sediments in areas where geomorphologic-geologic data alone are insufficient for the purpose, especially in the Recent geologic areas in the delta. This possibility, if sustained, may be realized right in the field. All equipment and reagents for the test are easily portable and the test itself requires only a few minutes. It is my hope to ascertain further validity of the test in the coming season, all other things being favorable.

A tentative view of the significance of the observations here stated may be as follows. The Cu-Zn occluding mechanisms are very common in Recent materials of Mississippi River origin but not in the Red River sediments and, perhaps, not in the Arkansas River sediments. These mechanisms may deteriorate when the sediments containing them are exposed to sub-aerial pedogenesis. The zinc-occluding mechanisms tend to deteriorate and disappear, in the Recent, far more rapidly than the copper-occluding mechanisms. Loessification of sediments tends either to conserve or to produce the copper-occluding mechanisms.

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Some Observations on the Pathogenicity of Isoniazid-Resistant Variants of Tubercle Bacilli¹

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It has been demonstrated (1) that the incidence of variants of tubercle bacilli resistant to isoniazid (INH) is even higher than is the case with streptomycin—a most disappointing observation in terms of what one could predict at that time concerning its usefulness in the treatment of tuberculosis. Since then we have had the opportunity of investigating more intensively the properties of these INH-resistant mutants both in the experimental laboratory and in the clinic.

The Vallée strain (bovine) and the H37Rv strain (human) were exposed to isoniazid on the oleic acid

¹ Presented before the Colorado Trudeau Society April 18, 1953.

TABLE 1
PATHOGENICITY OF TUBERCLE BACILLI IN SPUTUM CONCENTRATES FROM PATIENTS TREATED WITH INH FOR AT LEAST 2 MONTHS

No. of Cases	Culture results		Pathogenicity for normal guinea pigs
	Primary isolation	Subcultures from animals	
4	<i>S</i> INH < 1 µg/ml OA+; ATS+	<i>S</i> INH < 1 µg/ml	Typical generalized visceral tuberculosis
9	<i>R</i> INH > 1 µg/ml OA+; ATS+	<i>R</i> INH > 10 µg/ml (2 cases) <i>R</i> INH > 1 µg/ml (5 cases) Partially sensitive to 1 µg INH/ml (2 cases)	Local abscesses; enlarged lymph nodes; smears positive for AFB
5	<i>R</i> INH (not known) OA-; ATS+	Negative cultures from abscesses and spleens	Local abscesses; enlarged lymph nodes; smears positive for AFB
3	<i>R</i> INH (not known) OA-; ATS±	Negative cultures from abscesses and spleens	Local abscesses; normal to slightly enlarged lymph nodes; smears positive for AFB

Note. *S*, sensitive; *R*, resistant; OA, unmodified oleic acid albumin agar medium; ATS, American Trudeau Society egg yolk potato medium; +, growth; -, no growth; ±, growth rare or absent; AFB, acid-fast bacilli.

albumin solid medium (OA medium), and variants, each resistant to 10 µg of INH/ml of medium, were isolated and subcultured through three passages in medium containing 10 µg of INH/ml. Then these organisms were tested for their pathogenicity by injection into each of two normal guinea pigs intravenously in a dose of 1 cc of undiluted Tween-albumin culture. The parent isoniazid-sensitive strains of H37Rv and Vallée were also used at the same time to infect each of two guinea pigs with the same numbers of living bacterial cells. The two guinea pigs injected with the isoniazid-sensitive Vallée strain died, as expected, at 12 and 19 days after infection. The companion animals infected with the strain resistant to more than 10 µg of INH/ml survived for 33 and 43 days respectively; the animal surviving for 33 days died of an unknown cause and with only minimal evidence of active tuberculosis; very few acid-fast rods were visible in a stained smear of its lungs. The animal which died on the 43rd day after infection probably died of tuberculosis, although there is no doubt that this isoniazid-resistant bovine strain had suffered striking loss of pathogenicity. The two guinea pigs injected with the INH-sensitive H37Rv strain died on 19 and 25 days respectively, of extensive tuberculosis. Yet, their companions infected with the INH-resistant H37Rv strain are still living now at 60 days. Thus, the INH-resistant Vallée strain was at least partially attenuated compared with its parent INH-sensitive strain, whereas the INH-resistant H37Rv strain is revealed to be markedly attenuated, if not completely avirulent, when compared with the parent INH-sensitive H37Rv strain. These experiments indicated that these strains of tubercle bacilli may become partially or completely attenuated for the guinea pig when they become resistant to 10 µg of INH/ml of OA or Tween-albumin liquid medium, under experimental laboratory conditions.

Studies have subsequently been made on tubercle

bacilli freshly isolated from patients treated for at least 2 months with INH alone or INH plus streptomycin and other chemotherapeutic agents.

Eleven different strains resistant to at least 1 µg of INH/ml of OA medium were isolated from as many patients. These strains were first isolated on medium containing 1 µg of INH/ml and then subcultured only once or twice in Tween-albumin liquid medium without INH and used to infect guinea pigs; two guinea pigs were injected intravenously with 1 cc of fully grown undiluted Tween-albumin culture. Subcultures were made from the lungs and spleens of animals that died in less than 60 days after injection, and on all animals that were still surviving and were, therefore, sacrificed at 60 days. The organisms so isolated were tested for their resistance to 1 and 10 µg of INH/ml, and, in some cases, to higher concentrations of INH. Three of these strains proved to consist exclusively of populations completely resistant to 10 µg of INH/ml of OA medium; and the guinea pigs infected with these strains survived for 60 days. At necropsy no evidence of tuberculosis was discovered in these guinea pigs. Seven of these strains consisted of populations resistant to 1 µg, but partially or completely sensitive to 10 µg, of INH/ml; all guinea pigs infected with these strains died within 60 days after challenge. One strain proved to be sensitive to 1 µg of INH/ml; and the guinea pigs infected with this strain died at 17 and 27 days of generalized tuberculosis. The results of this preliminary survey have led us to the conclusion that resistance of human type tubercle bacilli to 1 µg of INH/ml of medium is not always associated with a significant degree of attenuation, but that, on the other hand, resistance to 10 µg or more of INH/ml of OA medium may be accompanied by marked loss of pathogenicity for normal guinea pigs.

In addition to these observations, carried out under relatively controlled conditions, we have made the following observations with primary sputum concentrates

from patients who had previously been treated with INH for at least 2 months. Twenty-one sputum concentrates, all of which were positive on smear for acid-fast rods, were inoculated onto American Trudeau Society egg medium, onto OA medium, and into guinea pigs, two guinea pigs for each specimen. These injections were made into the groin by the classical method. Table 1 summarizes the results obtained from the study of these 21 sputum concentrates. It will be noted that 4 of these strains proved to be pathogenic, growing on both the OA and the ATS media and causing extensive visceral tuberculosis within 2 months after infection; subcultivation and primary testing for sensitivity to INH proved them to be invariably sensitive to 10 μ g of INH, and completely or partially sensitive to 1 μ g of INH. The remaining 17 strains caused little or no tuberculosis to develop in the guinea pigs within the 2-month period before sacrifice. The tuberculosis which did develop consisted of local abscesses at the sites of injection and occasional necrotic lymph nodes draining these sites. Subcultivation from these lesions revealed either no cultivatable bacterial cells or populations consisting predominantly of tubercle bacilli resistant to more than 1 μ g of INH. Of some interest is the fact that all these local lesions at the sites of inoculation contained acid-fast rods demonstrable on direct smear.

Of special significance for our present studies is our unexpected observation that 8 of these nonpathogenic strains of tubercle bacilli failed to grow on the unmodified OA medium, although 5 of them gave good growth on the ATS medium. The 3 remaining strains, which failed to grow on either OA medium or the ATS medium, and which did not produce progressive disease in guinea pigs are of particular interest to us. All 3 of these patients persistently cough up acid-fast rods which are invariably present on direct smear and present in enormous numbers in sputum concentrates. There is little doubt in our minds that these acid-fast rods must derive from a multiplying population in their respiratory tracts—in all likelihood in one or more of the cavities which are visible by x-ray in these patients. Cultures of tubercle bacilli were readily isolated on egg medium from these patients before INH therapy was initiated. It seems possible that these observations are related, at least in part, to Fisher's observation (2) that a variant of the H37Rv strain, resistant to more than 10 μ g of INH/ml of medium, has growth requirements different from the parent INH-sensitive H37Rv strain.

We wish to emphasize that these data refer only to pathogenicity of tubercle bacilli for normal guinea pigs, because, as yet, we have no direct, conclusive evidence that these INH-resistant strains of tubercle bacilli are equally nonpathogenic for normal human tissue. Indeed, it is already clear that these organisms can proliferate in open cavities in human lungs. Thus, it would appear that with the development of resistance to the antimicrobial effects of INH, tubercle bacilli acquire an inability to initiate multiplica-

tion in normal, non-necrotic areas of guinea pig tissue.

As is well known, tubercle bacilli multiply in lung cavities in association with many autolyzing leucocytes. Therefore, it is tempting to postulate that most strains of tubercle bacilli which are resistant to more than 10 μ g of INH/ml of artificial medium have a special growth requirement for a substance (or substances) which, on the one hand, is present but bound and unavailable in normal tissue, but, on the other hand, free and available to these fastidious strains in necrotic tissue. This substance (or substances) is evidently present in moderate but not always sufficient amount in egg yolk media, and is present in much smaller quantities in the OA medium.

We would like to point out and warn that the population of tubercle bacilli which appears in the sputum of an INH-treated patient, may, and often does, consist of mixed populations of organisms with various degrees of resistance to INH and, thus, of mixed populations with varying degrees of pathogenicity. Also, reversion of strains from INH-resistance and nonpathogenicity for normal tissue to INH-sensitivity and pathogenicity has already occurred in our laboratory on repeated subcultivation in medium deficient in the special growth factor(s) to which we have already referred. The observations reported here have many implications for the future with respect to the diagnosis, treatment, and epidemiologic control of tuberculosis. These are beyond the scope of this paper.

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Radioactive Measurement of Proteolytic Activity

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Proteolytic enzymes play a vital role in many physiological and pathological phenomena of the body. Not only are they essential for normal every day economy, but abnormalities in their concentration have been believed to be the cause of many pathologic states. Among these are: pancreatitis (1, 2), obstetrical complications (3), bleeding dyscrasias (4), venous thrombosis (5), and cancer (6).

The measurement of this proteolytic activity in body fluids has been quite difficult. Most methods have not been direct since they measure antiproteolytic factors, nor have they lent themselves to simple quantitative measurement (2, 7, 8).

A procedure for direct quantitative estimation of proteolytic activity has been devised. The principle of the method depends upon the digestion of I^{131} -labeled albumin by a proteolytic enzyme. This will result in

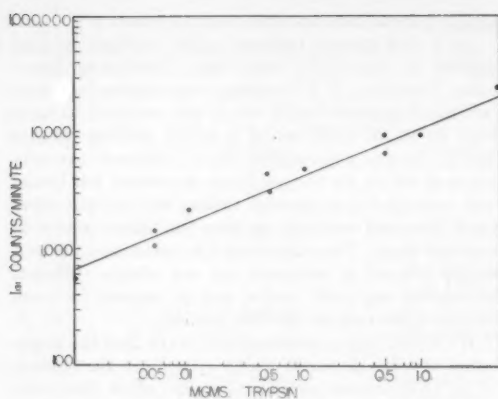


FIG. 1.

formation of unbound radioiodine that, though not necessarily in inorganic form, is no longer attached to the whole protein and may be separated from the latter by selective precipitation of the albumin. The radioactivity contained in the supernatant should then be proportional to the proteolytic activity of the enzyme.

Radioactive iodinated albumin is dialyzed against cold running water for 72 hr to free it of any unbound inorganic I^{131} . The proteolytic solution is then added to the labeled albumin. After 20 min, 1 cc of β -naphthalene sulfonic acid and 1 cc of human serum albumin as a carrier are added to precipitate the proteins. The mixture is centrifuged and the supernatant plated and counted with a thin end-window Geiger-Müller tube.

The results using varying concentrations of trypsin (Tryptar-Armour) in 1 cc of solution are shown in Fig. 1.

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Various Absorption Coefficients for 23.5-Mev X-Rays

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In choosing the material for a window through which one can view patients receiving betatron x-ray therapy, it was necessary to measure the half-value

TABLE 1
23.5 MEV X-RAYS

Material	Half-value layer	Absorption coefficient
Water	29.6 cm	0.023 cm^{-1}
Glass	11.9 cm	0.058 cm^{-1}
Zinc bromide	9.4 cm	0.074 cm^{-1}
Lead glass	3.6 cm	0.19 cm^{-1}
Lead	1.4 cm	0.48 cm^{-1}

layers of glass,¹ lead glass, water, and zinc bromide.² It was found necessary to have a protective window-thickness providing about 8-9 half-value layers of absorbing material to protect the betatron personnel in the control room satisfactorily.

K. R. Ferguson (1) and others have discussed various liquid and solid absorbers for window constructions that can be used for high energy radiation protection. In order to select the best material in respect to lowest space consumption and cost as well as chemical stability, the following absorption coefficients were measured with a 23.5-Mev x-ray beam.

The absorption coefficients of glass, lead glass, and

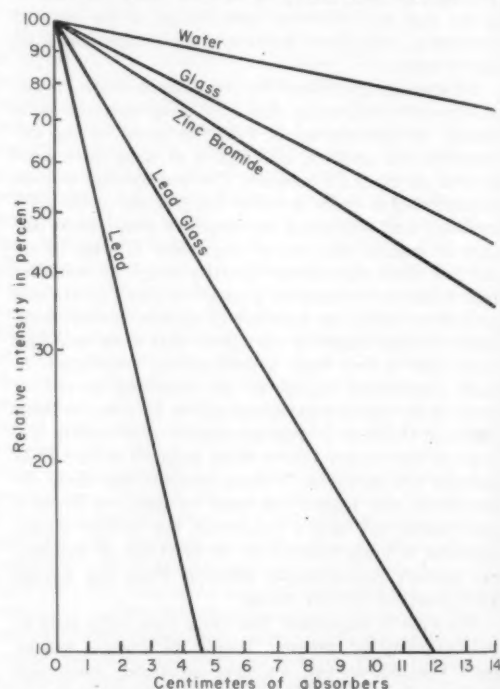


FIG. 1. Absorption qualities of various materials for protective windows against 23.5 Mev x-rays are shown. The lead curve is given for comparison.

¹ Samples of plate glass and lead plate glass were furnished by the Pittsburgh Plate Glass Company.

² Zinc bromide solution containing hydroxylamine hydrochloride to prevent coloring due to oxidation products was supplied by the Dow Chemical Company.

lead metal were determined by placing absorbers of these materials in front of a Victoreen thimble ionization chamber (25 r) situated within an 8-cm square lucite block (2) at a distance of approximately 100 cm from the betatron target. A well-collimated and uniform 6-cm-diameter beam of 23.5-Mev maximum x-ray energy was employed.

The values for water and zinc bromide were measured in a lucite tank. A small ion chamber was moved along the axis of the beam by remote control (3). The instantaneous ionization current at any point was amplified and recorded. The field size was 10×12 cm at 100 cm from the target. Inverse square correction was applied to all readings. The characteristics of the different materials are shown in Table 1 and Fig. 1. Measured values for lead are given for comparison.

It should be noted that the data show only the rate of absorption due to ionization after the electronic equilibrium has been reached, which is at approximately a depth of 4 cm for water.

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The Dynamic Equilibrium between Circulating and Extravascular Plasma Proteins¹

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It has been demonstrated that after intravenous administration of native (1) and labeled heterologous (1, 2) and homologous (3-6) plasma proteins to animals and labeled (6) and native (7, 8) homologous plasma proteins to humans, approximately half of the administered plasma protein, exclusive of that amount catabolized, leaves the circulation within the first few days. The importance of the nature of the label, the manner in which labeling has been performed, and, in the case of heterologous proteins, the activity of the reticuloendothelial system and the influence of antibody production in these experiments has been discussed (1, 6).

The extravascular distribution of native heterologous plasma proteins in animals (9, 10) and native homologous plasma proteins in humans (7, 11) has also been investigated; specific plasma proteins were found in the connective tissues and in the cells of many organs. In instances of a marked deficiency of a

specific circulating plasma protein in humans, γ -globulin in agammaglobulinemia (8) and fibrinogen in congenital afibrinogenemia (7), it has been found that extravascular sites in these patients are also depleted of the specific plasma protein (7, 11). Extravascular deficits of the given plasma protein in these patients could be quickly rectified by intravenous administration of the protein (7, 11).

Although it has been demonstrated that an excess of a given plasma protein in the circulation will shift extravascularly, for a true equilibrium to exist between the intravascular and extravascular pools of plasma protein, it must also be shown that an excess in the extravascular compartment will result in movement of the protein into the circulation. It was the purpose of this investigation to demonstrate, if possible, the reversible nature of the shift of protein between the intravascular and extravascular compartments.

Rabbit antisera vs. pneumococcus type III polysaccharide were employed in this study since the antibody could be detected by its immunochemical reactivity with specific antigen without additional labeling. The antisera were passively transferred to normal rabbits, thus avoiding the question of synthesis by the host animal of the protein being measured. The levels of antibody in the circulation were determined by the method of Heidelberger et al. (12), the specific precipitates were measured spectrophotometrically (13). The antisera used were pooled, fractionated with ammonium sulfate at half (0.5) saturation, and the precipitate was dialyzed exhaustively against saline buffer ($\Gamma/2$ NaCl = 0.1, $\Gamma/2$ phosphate = 0.05) and then against 0.15 M NaCl. The filtered concentrated solution contained 16.9 mg antibody/ml and represented a 10% solution of protein. Prior to intravenous administration, a volume of blood equal to the amount of antiserum to be injected was removed from an ear vein. The following experiments were performed and the results are recorded in Fig. 1.

Expt. 1. Effect of exchange transfusion. Four rabbits were given 20 ml antiserum intravenously. At the end of the 4th day of equilibration, the right femoral vein in each of the rabbits was exposed, and a No. 19 polyethylene catheter was inserted through an incision in the vein wall.

A. Two of the rabbits were then given exchange transfusions of 300 ml of normal rabbit blood, with removal of blood and its replacement in 10-ml aliquots over a period of an hour. The exchanged rabbits demonstrated the expected fall in circulating antibody immediately following the procedure; a rapid rise in circulating antibody soon occurred.

B. The 2 control rabbits were not treated and they showed no significant alteration of circulating antibody other than a continued logarithmic decay over this same period.

Expt. 2. Effect of injection of specific antigen. A. Four rabbits were given 18 ml of antiserum intravenously, and at the end of the 2nd day were given 2.2 mg of pneumococcus polysaccharide III intra-

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²The authors wish to thank Lederle Laboratories, Inc., for the generous supply of rabbit antiserum and pneumococcus polysaccharide used in these experiments.

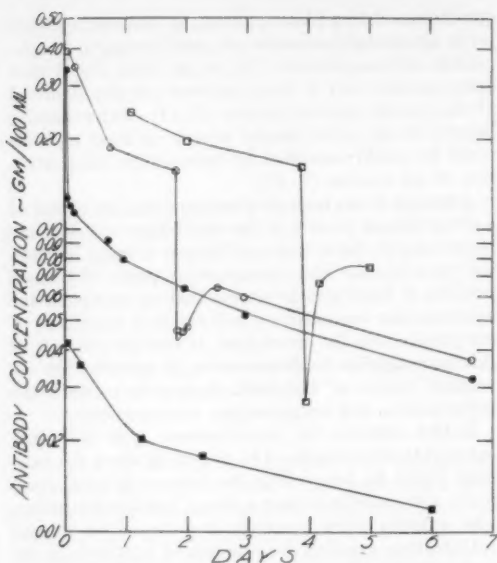


FIG. 1. All individual points on these curves represent the average values for the rabbits within a given experimental group. \square Expt. 1 A; \circ Expt. 2 A; \bullet Expt. 2 B; \blacksquare Expt. 3.

venously in 1.0-ml volume, slowly. This amount of polysaccharide was calculated as enough to remove most but not all of the antibody circulating at that moment, the complex presumably being removed from the circulation in a short period of time. As can be seen, the level of circulating antibody fell immediately after administration of the specific antigen. A secondary rise soon occurred, however, and the circulating antibody then resumed its previous rate of logarithmic decline.

B. Two rabbits were given 15 ml of the same antiserum intravenously and then, after 20 min, 2.2 mg of polysaccharide III were injected. An immediate fall in circulating antibody occurred; the antibody then assumed a logarithmic rate of decline proportionate and parallel to the curve for the 4 rabbits in Expt. 2 A, and closely approximating it after the secondary rise in circulating antibody had taken place in the latter rabbits.

Expt. 3. Effect of reinfusion of antibody removed after equilibrium reached. To determine if the initial rapid fall in circulating antibody, observed in the rabbits of Expt. 2 A before the decline became exponential, was dependent upon the disappearance of antibody molecules with markedly shorter half-lives, serum derived from blood removed from the rabbits of Expt. 1 A during exchange transfusion was injected into 2 other rabbits after 3-fold concentration by negative pressure dialysis and centrifugation twice at 4000 rpm at 0°C for 30 min. Twenty-five milliliters of this serum were given intravenously to 2 rabbits after removal of 25 ml blood. The same initial rapid fall was observed. Since the donor rabbits had been in

equilibrium with respect to circulating antibody, the derived serum presumably should have contained little or no antibody of very short half life. Hence it seems reasonable to conclude that the initial rapid fall following infusion of a plasma protein is, as has been previously postulated, an equilibration of the circulating protein with the extravascular protein pool.

The half life of the rabbit antibodies in these experiments varied between 5 and 7 days, which agrees with the values already reported (14, 15).

It would appear from the data that preformed plasma protein present in the extravascular pool can move rapidly into the circulation upon depletion of the specific protein in the latter compartment. Thus, the extravascular plasma protein is in dynamic equilibrium with the intravascular plasma protein; once equilibrium is established, a decrease in the mass of a specific plasma protein in one compartment results in the movement of that plasma protein to that compartment until equilibrium is again attained.

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A Homogeneous Cell Preparation from Soybean Leaves^{1,2}

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A typical dicotyledonous leaf is composed of three major types of tissue: epidermis, minor venation, and mesophyll. From the data of Wylie (1) these tissues appear to be present in roughly equal amounts. The specific biochemical contributions of the individual tissues to the general physiology of the leaf are essentially unknown (except, of course, for the photosynthesis of the mesophyll). Whereas epidermal cells may be obtained frequently merely by stripping, no procedure exists for obtaining mesophyll cells in

¹Contribution No. LR-144.

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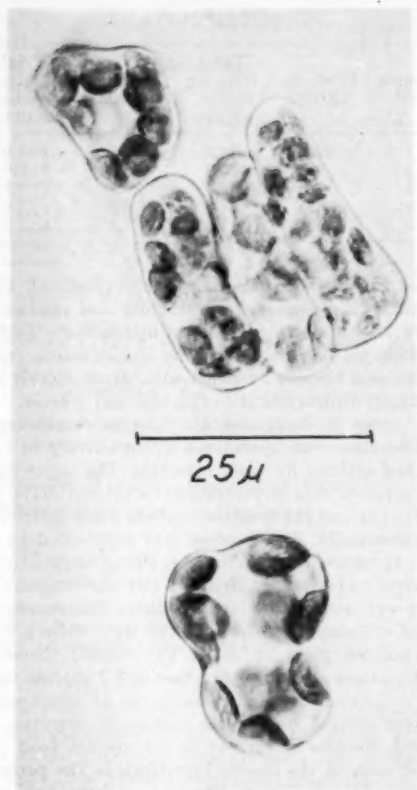


FIG. 1.

quantity. We find that soybean leaves (var. Hawk-eye) will yield a tissue-free mesophyll preparation when carefully ground with 0.25 *M* sucrose, 0.05 *M* phosphate (pH 6.8) at ca 4° C. A test tube homogenizer with a loosely fitting pestle is used and the resulting suspension is filtered through bolting silk (ca 100 threads/in.). The filtrate is centrifuged at very low speed (ca 80 rpm) for several minutes. Upon discarding the supernatant and resuspending the cells in a nutrient solution, a tissue-free preparation of parenchyma cells is obtained (Fig. 1).

An illuminated, fresh cell preparation is capable of fixing $C^{14}O_2$ at a rate corresponding roughly to one-fifth that of a normal leaf on the basis of chlorophyll concentration. The intact excised leaf and the cell suspension show qualitative equivalence in the formation of 80% ethanol-soluble products (Fig. 2) and starch- C^{14} , but they are vastly different in their abilities to synthesize protein. While a leaf will form 10–15% of the total ethanol-insoluble material as protein in 30 min, the free-cell preparation will form none. The latter system has been subjected to various time, temperature, and nutrient conditions, without any evidence of radioactivity in the protein. That this is not an artifact arising from the method of preparation was shown as follows. An intact excised leaf was exposed to $C^{14}O_2$ in the light for 2 hr. A cell suspension was then made by our usual technique, analysis of which showed a large fraction of the radioactivity in the protein.

However, the failure of the cell preparation to form protein is not correlated with the inability to form amino acids from photosynthate. In the 30-min photosynthesis the cells had accumulated ca 35% of their 80% ethanol-soluble radioactivity in the form of the amino acids alanine, glutamine, aspartic acid, glycine,

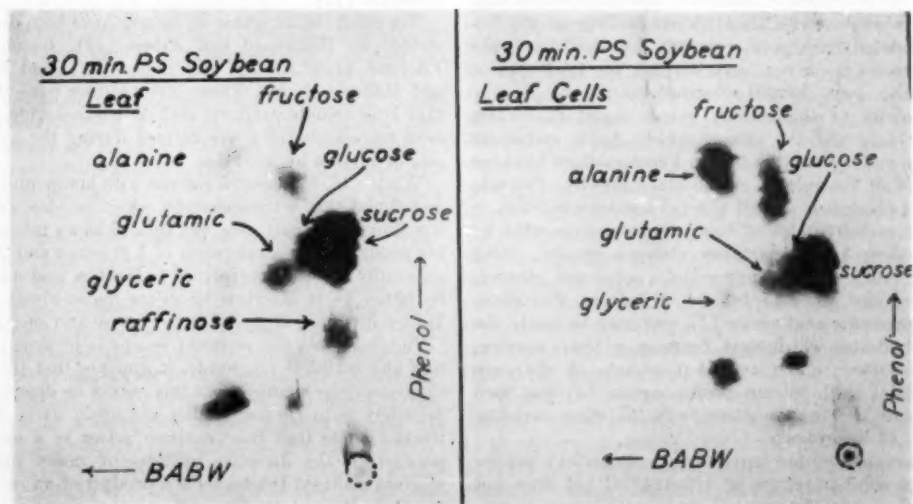


FIG. 2.

and serine.³ It is apparent that the cells are unable to form protein from these amino acids. The system is thus unique in that it demonstrates protein synthesis to be a more sensitive reaction than photosynthesis. Unfortunately, another physiological malfunction is the rapid decrease in the rate of photosynthesis with the age of the preparation, without visible sign of deterioration. The loss in the ability to assimilate $C^{14}O_2$ is essentially logarithmic, only 20% of the original rate remaining after 1 hr at 23° C (in weak light prior to stronger illumination). It is, of course, possible that the same factors operating in negating protein synthesis are involved in the degradation of the photosynthetic system.

The preparation is intriguing as a possibility for the study of the nutrition and function of a specific type of tissue in leaves, akin to that of a highly specific organ in an animal.

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Manuscript received April 27, 1953.

³ These are also the only amino acids formed by an intact leaf within the same time period. The fact is that even without the simultaneous formation of all the essential amino acids, protein synthesis (probably partial turnover) occurs in excised leaves. This question will be discussed in a subsequent publication.

Fructomaltose, a Recently Discovered Trisaccharide Isolated from Honeydew

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A trisaccharide, fructomaltose, has been isolated from the honeydew produced by the citrus mealy bug, *Pseudococcus citri* (Risso), while feeding on the sap of etiolated Irish potato sprouts. Fructomaltose was not present in the potato sprout sap. The trisaccharide has also been located chromatographically in the honeydews of the cottony maple scale, *Pulvinaria vitis* (L.), and the spirea aphid, *Aphis spiraeicola* Patch, and in honeybee honey. Fructomaltose has been located in the excreta of the black blowfly, *Phormia regina* (Meigen), when it was fed a sucrose solution.

The carbohydrates of honeydew were separated by descending paper partition chromatography, using Whatman No. 1 filter paper and a *n*-butanol, ethanol, acetone, and water (5-4-3-2 v/v) solvent. Benzidine-trichloroacetic acid spray (1) was used to locate the carbohydrates which were fructose, glucose, sucrose, fructomaltose, and glucose-1-phosphate. A charcoal-infusorial earth column chromatogram (2) was used to isolate the fructomaltose from the other carbohydrates of honeydew.

Fructomaltose is nonreducing to Benedict's copper sulfate solution, chars at 118-124° C but does not melt, is dextrorotatory, and apparently is very hygroscopic. A satisfactory rotation value has not been ob-

TABLE 1

Sample No.	Fructose, $\mu\text{g}/\text{mm}$	Total reducing sugars, $\mu\text{g}/\text{mm}$	Maltose, $\mu\text{g}/\text{mm}$	Weight ratio Fructose/maltose
1	17.5	52.9	34.5	1: 1.97
2	8.2	25.0	16.8	1: 2.05
3	13.2	44.5	30.9	1: 2.27
4	8.0	24.6	16.6	1: 2.07
5	14.0	45.8	31.8	1: 2.27

tained and the sugar has not been crystallized. Fructomaltose is hydrolyzed to fructose and maltose by either yeast invertase or dilute hydrochloric acid, to fructose, glucose, and sucrose by human saliva, and to glucose and sucrose by pancreatin. Hydrochloric acid eventually hydrolyzes it to fructose and glucose.

In order to determine the monosaccharide ratio, fructomaltose was hydrolyzed quantitatively to fructose and maltose by yeast invertase. The sugar-invertase solution was deproteinized with $\text{Ba}(\text{OH})_2$ and ZnSO_4 (3) and the fructose/maltose ratio determined colorimetrically. The fructose was determined by the Roe (4) method and the total reducing sugars by the Somogyi (5) method. Nelson's (6) chromogenic reagent was used in the latter method. The results obtained are shown in Table 1. The data show a fructose/maltose ratio of 1:2, by weight; therefore, fructomaltose contains 1 fructose and 2 glucose units.

It is believed that fructomaltose is an intermediate product formed during the action of invertase on sucrose. Sucrose is present in the normal food supply of each of the insects investigated. The presence of invertase in insect digestive systems has been demonstrated by many investigators including Sarin (7), Bertholf (8), Phillips (9), Herford (10), and Fraenkel (11).

The effects of invertase on sucrose have been demonstrated by Blanchard and Albon (12), Bacon and Edelman (13), Aronoff and Bacon (14), and White and Maher (15, 16). These investigators have shown that intermediate products such as trisaccharides, and even tetrasaccharides, are formed during the hydrolysis of sucrose by invertase.

White (15, 16) treated sucrose with honey invertase and found that a trisaccharide, which he identified as α -maltosyl- β -D-fructoside was formed as an intermediate product. It was composed of 1 fructose and 2 glucose units and was hydrolyzed to fructose and maltose by either yeast invertase or dilute hydrochloric acid. Honey invertase degraded it to glucose and sucrose.

Judging from the reported reactions of fructomaltose and maltosyl fructoside, it appears that the two sugars may be identical, but this cannot be determined definitely until further studies are made. It is of interest to note that fructomaltose arises as a natural product in the digestive systems of many insects, whereas maltosyl fructoside is a product of an *in vitro* reaction. Present studies indicate that fructomaltose may be expected to arise in the digestive system of any

animal that possesses invertase and utilizes sucrose in its diet.

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Malignant Tumors Resulting from Embedding Plastics in Rodents¹

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In two previous communications (1, 2) we have described various types of sarcomas which were induced in rats and mice by embedding certain plastic films in the anterior abdominal wall just ventral to the fascia. The initial observations were made on rats in which one kidney had been wrapped in cellophane to produce hypertension. Seven of these rats, autopsied after nearly 2 yr, were found to have developed sarcomas around the wrapped kidney. Later experiments showed that subcutaneous embedding produced similar results and the abdominal wall technique is now generally used by us.

In addition to cellophane (regenerated cellulose) we have embedded a number of other plastics and have produced malignant tumors in a considerable percentage of the animals. These are all long-term experiments lasting usually 1-2 yr before the appearance, if at all, of a sarcoma. The final results of some of these experiments cannot be reported as yet, since in many cases the time elapsed after embedding has not been sufficient for the appearance of tumors.

Nevertheless there are practical reasons for publishing further results now, as plastics are being used more and more extensively on humans by surgeons and surgical specialists. It is, however, very important to note that so far there is no proven instance in the literature of a malignant tumor induced in man by embedding a plastic. (Paraffinomas are foreign-body reactions, not malignant growths.) On the other hand, oncologists have reminded us that if it takes 1-2 yr

¹ This work was supported by a grant from the National Cancer Institute, U. S. Public Health Service.

TABLE 1
TUMORS OBTAINED BY EMBEDDING PLASTICS
SUBCUTANEOUSLY

Completed Experiments		Malignant tumors produced	
Material	Animals	No.	%
Cellophane A	Rats	15/42	35.7
Cellophane A	Mice	8/35	22.8
Cellophane A	Mice (black)	1/22	
Cellophane B	Rats	20/44	45.4
Polyethylene A	Rats	10/80	12.5
Pure polyethylene	Rats	7/38	18.4
Pure polyethylene	Mice	3/29	10.3
Polyvinyl chloride	Rats	17/44	38.6
Glass coverslip	Rats	1/50	

Experiments Still in Progress			
Material	Animals	Malignant tumors produced	Animals still alive
Cellophane C	Rats	11	16
Pure polyethylene perforated	Rats	1	30
textile	Rats	1	31
Silastic	Rats	12	3
Teflon	Rats	4	15
Nylon	Rats	1 ²	21
Dacron	Rats	3	29
Dacron perforated	Rats	1	30
Polystyrene	Rats	2	22

for a malignant tumor to appear in a rodent, it may take 10-15 yr for a similar result in a human being.

Malignant tumors, adjacent to or actually surrounding the film, have been produced in rats or mice or both with the following plastics: (1) commercial cellophane film (regenerated cellulose), for convenience called by us Cellophane A; (2) the same cellophane film after it had been subjected to intensive extraction by methyl alcohol, called Cellophane B; (3) the same cellophane subjected first to alcohol and subsequently to benzene extraction, called Cellophane C; (4) polyethylene film, called Polyethylene A; (5) a pure polyethylene film, specially prepared for these experiments; (6) polyvinyl chloride film; (7) silastic, a silicone product; (8) Teflon film; (9) Dacron film; (10) polystyrene film; (11) with nylon film, so far only one tumor, a reticulum cell sarcoma surrounding the nylon, has appeared, 441 days after insertion. Successful transplantation of this tumor was made, producing reticulum cell sarcomas to the second generation. The remaining rats embedded with nylon are still under observation.²

To date the highest percentage of positive results (45.4%) was obtained by embedding cellophane B. Up to the present we have obtained a total of at least 126 primary tumors, including those from kidney wrappings, and many successful transplantations.

² Since the above was written 3 more sarcomas have appeared at the site of embedding nylon film.

At least 23 more substances (mostly other polymers or variants on those mentioned before) are being tested for their carcinogenicity, but they have been embedded too recently for any report at this time.

In addition to these plastics, we have similarly embedded other materials as controls. Adequate controls are of the greatest interest and importance in such an investigation; and, at this point an addendum must be made to our previous report in 1952 (2). In that publication we stated that up to that time no tumors had appeared with the three substances embedded as controls; i.e., (a) the linters from which the Cellophane A was manufactured, (b) sterile surgical cotton, and (c) chemically clean cover glasses. Recently, however, just before the completion of this last cover glass experiment, we obtained a solitary fibrosarcoma that surrounded a cover glass; this tumor appeared 659 days after the embedding, and was successfully transplanted. The cover glass was found broken into two fragments, but similar breaks were frequently found in the cover glasses that did not cause tumors. No certain explanation of this one exception among the controls can be made, but it is possible that some unknown carcinogen accidentally contaminated the cover glass at the time of the operation. In view of this single exception, a new series of control experiments is under way.

Subsequent to our publication, but independently, Druckrey (3) has induced sarcomas by similar procedures, using regenerated cellulose film and Polyamid film. He also produced peritoneal sarcomas by embedding platelets of cellophane in the peritoneal cavity of rats. Druckrey also observed that another rat, which had received cellophane orally, developed a lymphatic leukemia (lymphosarcoma) with malignant infiltration of the lymph nodes, liver, spleen, and lung. As this was the only such observation, we are speculating as to whether or not the leukemia was perhaps spontaneous.

The mechanism of production of these malignant sarcomas presents an interesting problem, and experiments are in progress to try to find an explanation. Types of tumors produced by embedding plastics are:

(1) *Malignant*: fibrosarcoma (the great majority are of this type), rhabdomyosarcoma, liposarcoma, osteogenic sarcoma, reticulum-cell sarcoma, lymphosarcoma, rhabdomyosarcoma (atypical), undifferentiated sarcoma, plasmocytoma, histiocytoma, myxoma, malignant mesenchymoma.

(2) *Nonmalignant*: 2 granulomas.

Table 1 shows the tumors obtained by embedding various plastics under the skin, the rodent used, the number of malignant tumors produced and the respective percentages.

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Volumetric Flasks and Microcell Filling Adapter for Use with the Perkin-Elmer Infrared Spectrophotometer¹

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One of the problems encountered in quantitatively handling a very few milligrams of material in a solution of a concentration great enough to permit the preparation of good infrared absorption records has been solved to a great degree with the use of the apparatus illustrated in Figs. 1 and 2.

The 1-mm Perkin-Elmer microcell (Fig. 1) re-

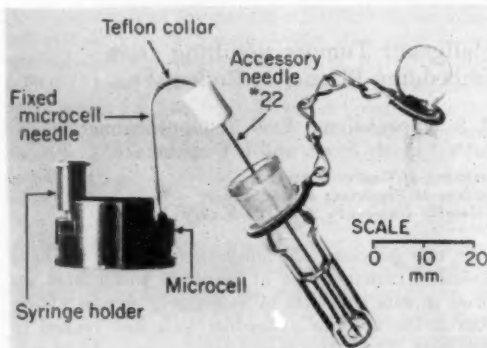


FIG. 1.

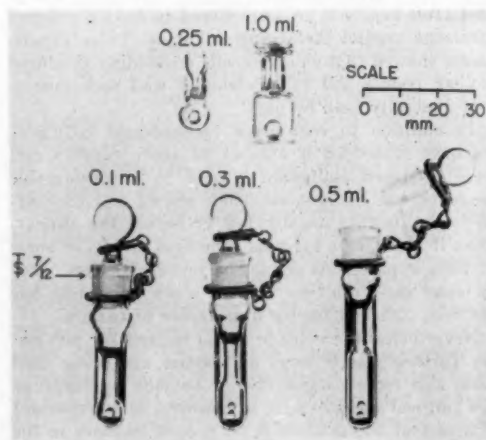


FIG. 2.

¹ Taken from a thesis submitted by O. D. Easterday as partial fulfillment for the degree Doctor of Philosophy. This work has been supported by grants from the Wm. S. Merrell Co., Cincinnati, and the American Cancer Society.

² Fellow of the National Institute of Arthritis and Metabolic Diseases, United States Public Health Service.

quires a volume of about 0.04 ml. By using a Teflon collar to connect the microcell needle to a second length of needle, it was possible to fill the cell from a solution volume of 0.1 ml by capillary action or by syringe in the usual manner. Thus the study of a 1-mg sample of a compound in 1% solution is possible. The flask illustrated in Fig. 1 has a calibration scratch on the constricted neck and a mixing bead which is slightly larger than the neck. The region of the flask above the neck is funnel shaped to allow easy addition of the sample by tapping the side of the flask with the finger. The glass stopper permits transportation and storage without loss due to evaporation.

Solvent additions are made by using a No. 22 needle attached to a syringe.

Figure 2 illustrates several sizes of these flasks which have been used. The two at the top without glass stoppers are early models that were used successfully, but with difficulty, since many of the solvents are readily volatile. The lower models were made for us.²

² Made by Thomas J. Scott, of Metro Industries, Long Island City 1, N. Y. They may be obtained commercially from this company.

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Comments and Communications

Sea Urchins Damage Steel Piling

SEA urchins have been discovered making holes in the steel 8-in. H-beam piles of a pier near Ellwood, California. The pier belongs to the Signal Oil and Gas Company and company engineers brought the problem to the Santa Barbara Museum of Natural History.

These piles, put down in 1929, had to be replaced when their damaged condition was discovered. The culprit was identified as the purple sea urchin, *Strongylocentrotus purpuratus*, a species that often bores in surf-pounded rocks and reefs.

On the steel piles they clung to the lower few feet, where they nestled in the depressions they had made. When removed, the metal under them was clean, bright, and rough.

Their action apparently augments corrosion. So many holes had already been made clear through the $\frac{3}{8}$ -in. web of the H-beam that it was all eaten away at the bottom, leaving the lower few feet of the flanges completely separated. About half of the 40 piles pulled at this pier were damaged in this way, and the engineers are anxious to learn how to prevent such expensive damage by sea urchins.

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Received March 23, 1953.

Thiouracil and Adrenal Glands

IN a paper on "Adrenal Hypertrophy in the White Leghorn Cockerel after Treatment with Thiouracil and Thyroidectomy" by Morris (1), the author erroneously ascribes to Baumann and Marine (2) the observation that feeding thiouracil to albino rats causes "atrophy and degeneration of the adrenal gland." Dr. Morris has missed the point of our report, and his search for the mechanism involved will be made simpler by a more careful reading of our

work. What we stated was that the total weight of the adrenal gland is almost always decreased by feeding thiouracil due to an involution (not atrophy) of the adrenal cortex. The medulla (3) on the other hand, undergoes a very marked hypertrophy, rarely to such an extent that the weight of the entire gland may be increased, in spite of the great involution of the cortex.

We hope this comment will help Dr. Morris in analyzing his experiments on the chick.

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Comparative Potency of a British and American Standard of Crystalline Vitamin B₁₂¹

THE growth of several microorganisms has been shown to be influenced by the vitamin B₁₂ concentration of the inoculated medium. These observations have led to the development of microbiological methods which are sensitive enough to assay the vitamin B₁₂ activity of body fluids. *Lactobacillus leichmannii* (1), and the green alga, *Euglena gracilis* (2, 3), have been found suitable for the assay of vitamin B₁₂ activity in serum. In both methods, the amount of growth of the organism in the test fluid is compared with that in a range of tubes containing varying known amounts of crystalline vitamin B₁₂. These latter tubes thus serve as standards.

¹ This study was made possible by a grant from the National Institutes of Health and in part by a grant from Squibb Institute for Medical Research.

OPTICAL DENSITY
(Colorimeter Readings)

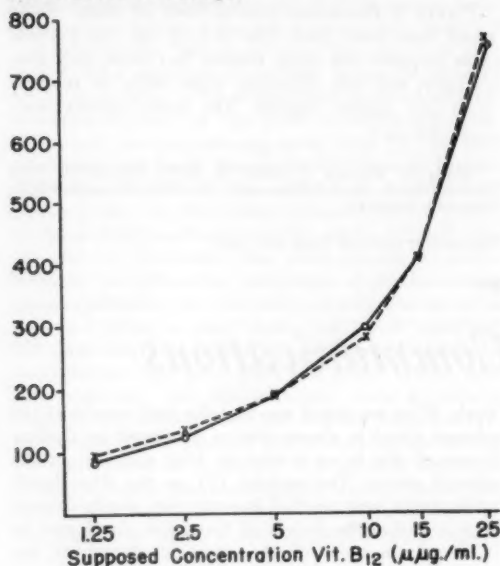


FIG. 1.

The normal range of vitamin B₁₂ concentration in human serum was found by Mollin and Ross (4), to be from 100 to 720 μg/ml, with a mean of 358 μg/ml. These results were obtained in England, using *E. gracilis* as test organism. Rosenthal and Sarett (5) in this country have found, by the *L. leichmannii* assay technique, a normal range of 80–420 μg/ml, with a mean of 200 μg/ml. Figures from this laboratory, using the *Euglena* method of assay, also tend to be lower than those reported by Mollin and Ross.

A possible source of this discrepancy could be a difference in the potency of the British and American standards of crystalline vitamin B₁₂. It was thought desirable therefore to compare the potency of a British² and an American³ preparation of crystalline vitamin B₁₂. Both products had been assayed by the respective manufacturers to contain 20 μg vitamin B₁₂/ml.

Freshly prepared dilutions of both standards were compared by their growth promoting effect for *E. gracilis*. Parallel dilutions were added to basal medium to give supposedly final concentrations ranging from 1.25 to 25 μg/ml. The density of growth of the *Euglena* for each dilution was recorded with a photoelectric colorimeter, using a red filter. Each dilution was tested in quadruplicate, and the readings averaged.

Growth pattern curves for the two preparations of vitamin B₁₂ have been constructed by plotting optical

density against the logarithm of the supposed concentration (Fig. 1). The curves are almost identical. The potency of these two preparations is therefore similar.

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Fossil Deposits Under the Entrance of Carlsbad Caverns

FRAGMENTS of pottery and sandals, wall paintings, and nearby mescal roasting pits indicate that the entrance to Carlsbad Caverns has long been used by the desert Indians as a natural shelter. Cave breathing provides the sheltered area with warm air in winter. During the summer, forced evaporation of the moist cavern breezes, as they come in contact with the hot, dry, desert air, makes the cave cool. This natural air-conditioning and the presence of a few small seeps of water provided a nearly perfect camping site for hundreds or even thousands of years (Fig. 1).

Apparently, victims of the hunt were taken to the cave entrance, the discarded bones thrown into the hole at the rear, which leads into the deeper parts of the caverns (Fig. 2). Remains left on the floor were often washed into the same hole by rain water. Once through this hole, the water fell to the floor of the main corridor, where its velocity decreased and its load of sediment, plant and animal remains, and guano, was deposited.

For hundreds of years, guano accumulated and formed a valuable source of rich, natural fertilizer.



FIG. 1. Present entrance to Carlsbad Caverns. (Photo courtesy H. Hemler, Carlsbad, N. M.)

² Cytamen, Glaxo Laboratories, Ltd., England.

³ Rubramin, E. R. Squibb & Sons, New York, N. Y.

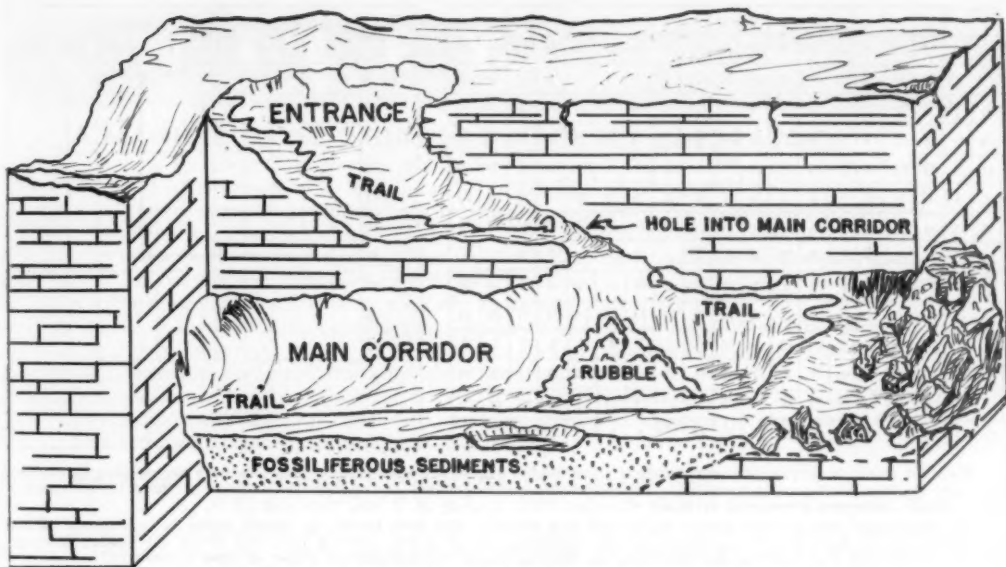


FIG. 2. Cross section through the Carlsbad Caverns entrance (not to scale).

Demands for this fertilizer by California citrus growers caused a mining company to remove the deposits and once again bare the fossiliferous sediments. One miner, J. L. White, became interested in the deeper, more scenic corridors and rooms. Stories told by him, and by those whom he guided through the caverns, created such a public demand to see the underground wonders that it was necessary to build trails to accommodate the increasing number of visitors.

Sediments of the fossil deposit were easily excavated and made excellent trail fill. It was the removal of this material that led to the original discovery of the gold mine of plant and animal remains. Careful sift-

ing of the dirt has resulted in the finding of teeth, horned-toad scales, bones of bats, rodent skulls, ribs and leg bones of many types of mammals, furculas and skulls of birds, a section of bone that had apparently been used as a bead by an Indian, and numerous bits of wood and leaves. The importance of this deposit has finally been recognized. Its study and deciphering will eventually unfold a fragmentary record of the men, plants, and animals that once lived in or near the entrance to Carlsbad Caverns.

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Received February 4, 1953.

A Simple Two-Dimensional Slide Rule for the Rapid Calculation of Time Intervals

A SIMPLE two-dimensional slide rule has been designed with which any desired units of time may be quickly and accurately computed. The same type of instrument lends itself to the computation of many other types of data provided they can be arranged in true arithmetic sequence and set up in tabular form. The instrument consists of two parts, a special overlapping chart of data and a sliding transparent window, with a measuring scale on the frame. Figures 1A and B show how this idea is adapted for counting time in days. The window used is 10 columns wide and of any desired length. On the main chart all the information is placed in the first 10 columns from the left, and the first 9 vertical columns are shifted up

one row and duplicated, as in Fig. 1A. This arrangement allows any date or figure on the chart to be placed under the window in any desired position. This is the basic procedure to be followed in constructing any such chart.

If information is needed in two units, e.g., pounds and ounces, the width of the window and the basic chart would be equal to the number of smaller units in the larger unit, e.g., 16(a) in the case of pounds and ounces. The whole chart would be 31(2a-1) columns wide, since all but the last column would be duplicated. The horizontal frame of the window would count off in smaller units, i.e., ounces, and the vertical frame the larger units, i.e., pounds.

One other type of computation for which the two-dimensional slide rule may be applied is that of a problem that can be reduced to the formula $(R-B)C$, where R is the reading, B a blank and C a constant. The chart would be set up to include values for RC

JAN	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
21	22	23	24	25	26	27	28	29	30	31	FEB	2	3	4	5	6	7	8
31	FEB	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
20	21	22	23	24	25	26	27	28	MAR	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
22	23	24	25	26	27	28	29	30	31	APR	2	3	4	5	6	7	8	9
APR	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
21	22	23	24	25	26	27	28	29	30	MAY	2	3	4	5	6	7	8	9
MAY	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
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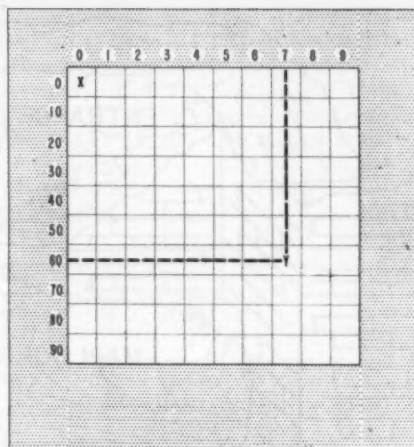


FIG. 1A (left). A portion of the main chart to be used in computing time in days, the length to be adjusted as desired. Note that the first 9 columns to the left are raised one row and duplicated on the right. Any section on the chart 10 columns wide will give an accurate sequence of dates.

FIG. 1B (right). The window overlay to be used with Fig. 1A. The area inside the dotted frame is transparent. Place the window on the chart in such a position that the beginning date is at zero position (x). Then locate the closing date (y) through the window and read the numbers from the window frame representing the elapse of time in days (67).

from $R=0$ to the largest value anticipated. In reading off computations, the window would be so placed that the number on the frame equal to B is placed opposite the value for $R=0$ on the chart, as 67 is placed opposite y in Fig. 1B. The computation for R would then lie at that point on the chart opposite the figures representing the R reading on the frame. Similar applications will no doubt suggest themselves. The full value of such an instrument can be appre-

ciated when a large number of computations is to be made.

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National Institutes of Health
Public Health Service, Department of Health,
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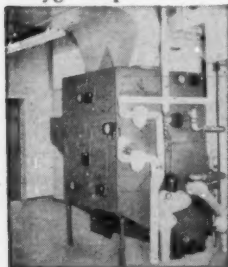
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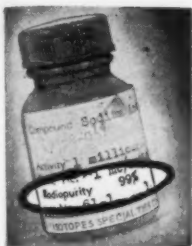
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Oct. 12-17. International Conference of National Committees on Vital and Health Statistics, WHO. London, England.
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Oct. 15. General Conference on Weights and Measures. Paris, France.
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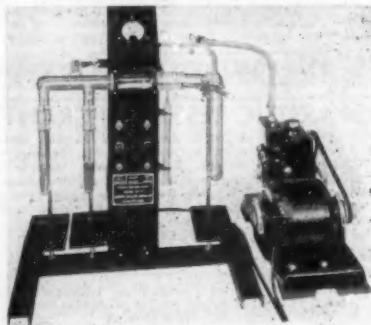
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120th AAAS MEETING

Boston, Mass., December 26-31, 1953

The list of hotels and their rates and the reservation coupon below are for your convenience in making your hotel room reservation in Boston. Please send your application, *not* to any hotel directly, but to the AAAS Housing Bureau in Boston and thereby avoid delay and confusion. The experienced Housing Bureau will make assignments promptly; a confirmation will be sent you in two weeks or less. **Share a room with a colleague if you wish to keep down expenses.** Mail your application *now* to secure your first choice of desired accommodations. All requests for reservations must give a definite date and estimated hour of arrival, and also probable date of departure.

HOTELS AND RATES PER DAY

Hotel*	Single	Double Bed	Twin Beds	Suites
BRADFORD*	5.75- 6.75	8.50- 9.50	9.95-13.00	14.00-18.00
COPLEY SQUARE-CS	4.00- 5.00	6.00- 7.00	6.00- 7.00	10.00-12.00
KENMORE-BB	6.00-10.00	9.00-14.00	10.00-14.00	18.00-21.00
LENOX-CS	4.50- 6.00	6.00- 8.00	8.00-10.00	14.00-16.00
PARKER HOUSE	5.75- 8.50	9.25-10.50	11.50-14.50	21.00-22.00
SHERATON PLAZA*-CS	5.85- 7.85	9.90-15.00	11.00-15.00	25.00-30.00
SOMERSET*-BB	6.00- 9.00	10.00-14.00	12.00-14.00	18.00-20.00
STATLER*	6.00-10.00	9.00-13.00	11.00-16.50	25.00 & up
TOURAINÉ	5.50- 7.50	9.50-10.50	9.75-12.00	18.00 & up
VENDOME-CS	4.50- 6.00	7.00	8.00-11.00	12.00-22.00

*Hotels starred have sessions in their public rooms. BB = Back Bay, CS = Copley Square; other hotels are downtown. The Bradford, Copley Square, Lenox, Statler, and Touraine can provide dormitory accommodations for parties of 3 to 5 at 2.75-3.00 per person. For a list of headquarters of each participating society and section, please see Association Affairs, *Science*, July 24, or *The Scientific Monthly*, July.

THIS IS YOUR HOTEL RESERVATION COUPON

AAAS Housing Bureau
Room 614-80 Federal St.
Boston, Mass.

Date of Application

Please reserve the following accommodations for the 120th Meeting of the AAAS in Boston, Dec. 26-31, 1953:

TYPE OF ACCOMMODATION DESIRED

Single Room Desired Rate Maximum Rate
 Double-Bedded Room Desired Rate Maximum Rate Number in party
 Twin-Bedded Room Desired Rate Maximum Rate
 Suite Desired Rate Maximum Rate Sharing this room will be:

(Attach list if this space is insufficient. The name and address of each person, including yourself, must be listed.)

First Choice Hotel Second Choice Hotel Third Choice Hotel

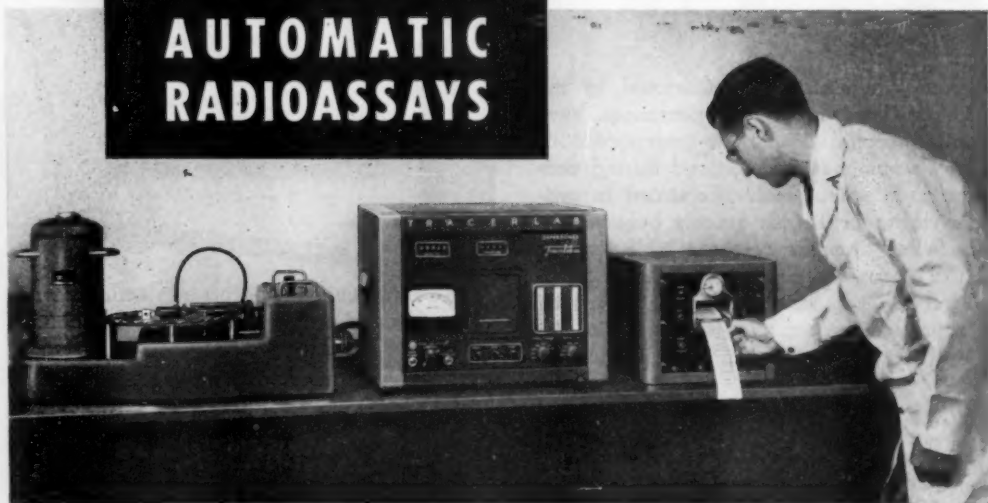
DATE OF ARRIVAL DEPARTURE DATE
 (These must be indicated—add approximate hour, a.m. or p.m.)

NAME
 (Individual requesting reservation) (Please print or type)

ADDRESS
 (Street) (City and Zone) (State)

Mail this now to the Housing Bureau. Rooms will be assigned and confirmed in order of receipt of reservation.

Reliable AUTOMATIC RADIOASSAYS



Automatic sample counting with Tracerlab equipment is now standard procedure in over 300 laboratories. By adding the Automatic Sample Changer and Tracergraph Printing Timer to either the Autoscaler or Superscaler and the Shielded Manual Sample Changer, a unit is obtained which incorporates many outstanding and exclusive features. With it an extremely flexible combination of radioassay techniques can be handled with ease and precision.

Automatic equipment gives faster, more accurate and more reproducible data; results in a substantial reduction in the technician's time needed for radioassay work; frees important laboratory personnel for more productive activities. Twenty-five samples can be counted without attention, or the same number of aluminum absorbers may be placed over a sample to obtain an absorption curve automatically. A large, circular, sample disc is used, thus preventing sample cross contamination and eliminating any chance of background buildup next to the G-M tube.

Samples may be removed and changed at will, without juggling samples, and the sample changer controls can be set either for continuous operation, or for one, two or three complete cycles only, without any delay between cycles. The Tracergraph, which prints elapsed time, may also be set to time continuously without resetting to zero after each sample count for half life measurements.

All electronic controls for the Sample Changer are in the scaler to provide a wider choice of preset counts and to take full advantage of the automatic features of the scaler. Tracerlab's new Scintillation Sample Changer will also fit the Automatic Sample Changer and thus provide laboratories with a completely versatile unit.

More complete information and specifications can be found in Issue No. 50 of *Tracerlog*. A copy will be sent on request.

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New Sealed Accessories

FOR CENTRIFUGING INFECTIOUS MATERIALS

Purpose

Laboratory administrators interested in the health of their laboratory personnel have recently become concerned with infectious aerosols sometimes encountered during centrifuging. Infectious materials sealed in centrifuge tubes or bottles quickly become airborne when they are released by a leak or fracture of the container due to high centrifugal forces. The natural draft created by the fan action of the rotating head acts to distribute the material through the laboratory.

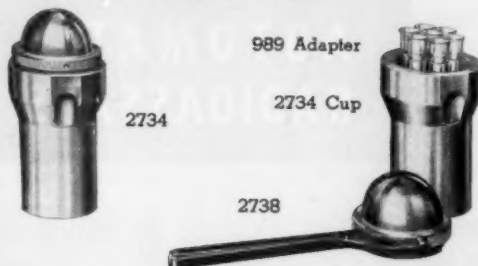
Approach

International Equipment Company engineers have adapted standard accessories to permit sealing of the centrifuge cup. To insure maximum safety, the scientist having completed centrifuging removes the sealed container to a hood for opening. In those instances where a leak or fracture has allowed the material to contaminate the container, immediate decontamination steps may be taken.

Solution

A series of accessories based upon the Hi-speed 250 ml. slotted cup has been designed. The standard cup is threaded to take a dome cover fitted with an O-ring seal. The cup holds one of the standard round or flat bottom 250 ml. centrifuge bottles. Adapters are available for holding: 2-50 ml. centrifuge tubes; 7-15 ml. centrifuge tubes; and 10-13 x 100 mm. serum tubes.

Centrifuge	Head	No. Cups	R.P.M.	R.C.F.
Size 1, Model SBV	277	4	3000	2000
Size 2, Model V...	277	4	2900	1880
Size 2, Model V...	266	6	2300	1410
Model PR-1.....	284	4	2400	1240



2734 — Duralumin Cup, 250 ml., with screw dome cover and gasket, including 582 rubber cushion — \$36.00.

2738 — Wrench, spanner type for tightening screw dome on 2734 — \$1.75.



2741 — Adapter, 2-place, for 50 ml. centrifuge tubes, fits 2734 or any standard IEC 250 ml. centrifuge cup — \$4.50.

989 — Adapter, 7-place, for 15 ml. centrifuge tubes, fits 2734 or any standard IEC 250 ml. centrifuge cup — \$18.00.

2740 — Adapter, 10-place, for 13 x 100 mm. serum tubes, will fit 2734 or any standard IEC 250 ml. centrifuge cup — \$21.50.

277 — Head, 4-place, steel pin type for 2734 or 384 cups — \$63.00.

266 — Head, 6-place, steel pin type for 2734 or 384 cups — \$95.00.

284 — Head, 4-place, steel pin type for 2734 or 384 cups — \$67.00.

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